Engineering Library

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The Engineer

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PUBLIC NOTICES

LEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 24th August, 1927, for ACCELERATED LOW-PRESSURE HOT WATER HEATING at Cricklewood Telephone Exchange, N.W.

Drawings, specification and a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the Contracts Branch, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners of H.M. Office of Works.) The sum so paid will be returned to those persons who send in Tenders in conformity with the conditions. 6125

The Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—

1. 8280 TONS STEEL FLAT-FOOTED RAILS, B.S. 75 R.
2. 467 COPPER PLATES for LOCOMOTIVES.
3. 2190 STEEL TYRES for ROLLING STOCK and 500 RETAINING RINGS.
4. 500 DISC WHEELS and AXLES, 700 DISC WHEEL CENTRES and 100 DISC WHEELS.
5. 137 STEEL BOILER PLATES.

Tenders due on the 16th August, 1927, for No. 1, on the 19th August, 1927, for Nos. 2 and 3, and on the 23rd August, 1927, for Nos. 4 and 5.

Specifications and forms of Tender obtainable from the above at a fee of 5s. per set, which will not be returned. 6151

Assistant Engineer Re- QUIRED by the GOVERNMENT of the GOLD COAST, for the PUBLIC WORKS DEPARTMENT, for a tour of 12 to 18 months' service, with possible extension. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, aged 28 to 35, should have been trained as Architects or Civil Engineers, and should be capable of Taking Entire Control of Construction of Concrete and other Buildings. A knowledge of Quantities and Measuring-up essential, also of Surveying and Road Construction. Students or Associate Members of the Institution of Civil Engineers preferred.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/15,502. 6136

Assistant Engineers (20) REQUIRED for the PUBLIC WORKS DEPARTMENT of the FEDERATED MALAY STATES for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment, he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 26, preferably unmarried, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers, and possess a Civil Engineering Degree or obtained such other diploma or distinction in engineering as the Secretary of State may decide in any particular case or have completed articles with a civil engineer of good standing, and have passed the examination for Associate Membership of the Institution of Civil Engineers. In addition, candidates must have had at least one year's practical experience of civil engineering under a qualified civil engineer.—Apply at once by letter, giving brief details of qualifications and experience and stating age and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting clearly at the head of application M/15224. 6105

Wanted, An Engineer TO TAKE CHARGE of the CATTERICK CAMP PUMPING STATION at Lowenthwaite, Nr. Richmond, Yorkshire. A general knowledge of Water Pumping, Plant and Filters is required and sufficient Chemical and Bacteriological knowledge to take daily tests for chlorination purposes.

Applicants should address the D.O.R.E. (Maintenance), Perronne Lines, Catterick Camp, Richmond, Yorks., giving particulars of previous experience and salary required. 6128

Wanted at Once, Tempo- RARY ENGINEERING ASSISTANT for London office, with sound knowledge and recent practice of Structural Steel Work Design.

Preference given to ex-Service men.

Apply, giving full particulars of experience, age, salary required, when disengaged, and enclosing copies of recent testimonials, to CIVIL ENGINEER-IN-CHIEF, Admiralty, S.W. 1. 6082

University of Birmingham.

FACULTY OF SCIENCE.

ENGINEERING DEPARTMENTS.

I.—MECHANICAL ENGINEERING.
"Chance" Professor: F. W. BURSTALL, M.Sc., M.A. (Cantab.), M.I. Mech. E.
II.—CIVIL ENGINEERING (AND TOWN PLANNING).
"Beale" Professor: CYRIL BATHO, M.Sc., D.Sc. (McGill), B.Eng., A.M. Inst. C.E.
III.—ELECTRICAL ENGINEERING.
Professor: WM. CRAMP, D.Sc., M.I.E.E.

THE FULL COURSES EXTEND OVER FOUR YEARS, and students who enter after matriculation and pass successfully the examinations at the end of each year will be ENTITLED TO THE DEGREE OF BACHELOR OF SCIENCE IN ENGINEERING.

THE SESSION 1927-28 COMMENCES ON OCTOBER 3rd, 1927.

For details syllabus of the Faculty, with full particulars of University Regulations, Lecture and Laboratory Courses, Fees, &c., apply to the REGISTRAR. 6030

PUBLIC NOTICES

University of Bristol.

FACULTY OF ENGINEERING.

(Provided and Maintained in the MERCHANT VENTURERS' TECHNICAL COLLEGE.)
VICE-CHANCELLOR: T. LOVEDAY, M.A.
DEAN of the FACULTY:
ANDREW ROBERTSON, D.Sc., M.I. Mech. E., Assoc. M. Inst. C.E.

DEPARTMENTS.

CIVIL ENGINEERING—Prof. R. M. FERRIER, M.Sc., M. Inst. C.E., M.I. Mech. E.
MECHANICAL ENGINEERING—The DEAN.
ELECTRICAL ENGINEERING — Prof. DAVID ROBERTSON, D.Sc., M.I.E.E.
AUTOMOBILE ENGINEERING—Prof. W. MORGAN, B.Sc., M.I.A.E.
MATHEMATICS—Prof. E. S. BOULTON, M.A., B.Sc.
GEOLOGY—Prof. S. H. REYNOLDS, M.A., Sc.D.
CHEMISTRY—Prof. F. FRANCIS, D.Sc., Ph.D., F.I.C.

Complete courses of study extending over three years leading to the University Degree or Diploma in Civil, Mechanical, Electrical, or Automobile Engineering.

A Sandwich Scheme of Training extending over five years may be adopted by selected students.

Full particulars of courses and of the University Halls of Residence may be obtained on application to the REGISTRAR, M.V.T. College, Bristol.

The Session 1927-28 commences on September 20th. 6031

University of Birmingham.

APPOINTMENT OF ASSISTANT LECTURER IN THE DEPARTMENT OF MECHANICAL ENGINEERING.

APPLICATIONS are INVITED for the POST of ASSISTANT LECTURER on MACHINE DESIGN. Stipend, £300 per annum. Duties to begin 1st October, 1927. Four copies of application, with testimonials, must be sent on or before August 24th to the undersigned, from whom further particulars may be obtained.

C. G. BURTON,
Secretary.

The University,
Edmund-street,
Birmingham,
August, 1927. 6134

PUBLIC NOTICES

University of Birmingham.

DEPARTMENT OF METALLURGY.

"FEENEY" PROFESSOR: D. HANSON, D.Sc.

THE SESSION 1927-28 COMMENCES ON OCTOBER 3rd, 1927.

The Course of Study covers three years and leads to the Degree of B.Sc. in Metallurgy. There is also an Honours School. Special attention is devoted to Iron and Steel, Copper, Brass, Metallography, the needs of local industries and to preparation for Colonial and Foreign Posts.

Research and other Scholarships.

For particulars apply to the REGISTRAR. 6076

The Royal Technical College, GLASGOW.

DEPARTMENTS OF ENGINEERING.

Mechanics and Mechanical Engineering:
Professor, ALEXANDER L. MELLANBY, D.Sc., M.I. Mech. E.
Associate Professor, WILLIAM KERR, Ph.D., A.R.T.C.
Electrical Engineering:
Professor, STANLEY PARKER SMITH, D.Sc., M.I.E.E., A.M. Inst. C.E.
Civil Engineering:
Professor, GEORGE MONCUR, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.
Mining Engineering:
Professor, DANIEL BURNS, M. Inst. M.E.
Chemical Engineering:
Professor of Technical Chemistry, THOMAS GRAY, D.Sc., LL.D., Ph.D., F.I.C.

Complete courses of instruction are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.

Composition fee, 25 guineas per annum.

SESSION 1927-8 BEGINS on TUESDAY, SEPTEMBER 20th.

Calendar, by post, 3s., and prospectus, gratis, may be obtained on application to the DIRECTOR. 5911

The Egyptian State Railways REQUIRE the SERVICES of TWO PERMANENT WAY ENGINEERS, one at £E450 per annum and the second at £E360 per annum. Particulars in regard to appointment can be obtained on application to

THE CHIEF INSPECTING ENGINEER,
Egyptian Government,
6123 41, Tothill-street, Westminster, S.W. 1.

PUBLIC NOTICES

West Ham Municipal College, ROMFORD-ROAD, STRATFORD, E. 15.

APPLICATIONS are INVITED for the POST of FULL-TIME ASSISTANT TEACHER in the DEPARTMENT of ENGINEERING from candidates with University Degree and Works experience. Salary in accordance with the Technical Burnham Scale for the London area, and subject to deduction for superannuation.

Forms of application may be obtained from the Principal, and should be returned not later than 10th September, 1927.

GEORGE E. HILLEARY,
Town Clerk.
29th July, 1927. 6144

B.B. & C.I. Railway Company. The Directors are prepared to receive up to Noon on Friday, 19th August, TENDERS for the SUPPLY of

STEEL SHAFTING, &c.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 10s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.
Offices: The White Mansion,
91, Petty France,
Westminster, S.W. 1.
28th July, 1927. 6124

Bengal-Nagpur Railway Com- PANY, LIMITED.

The Directors are prepared to receive TENDERS for :—

14 CYLINDRICAL OIL TANK WAGONS, 5ft. 6in. Gauge.

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, E.C. 2, on or after 2nd August, 1927.

A fee of 20s. will be charged for the specification, which is NOT returnable.

Tenders must be submitted not later than Noon on Friday, 12th August, 1927.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
R. C. VÖLKERS,
Secretary.
2nd August, 1927. 6127

City of Hull.

TRAMWAY RAILS.

The Corporation are prepared to receive TENDERS for the SUPPLY of 500 TONS TRAMWAY RAILS, 112 lb. to the yard, Hull section (centre groove), together with FISH-PLATES and SOLE-PLATES.

Forms of Tender and other particulars may be obtained of the undersigned.

Forms for the supply of rails will only be furnished to actual manufacturers or their accredited agents.

Tenders, endorsed as directed on the form of Tender, are to be addressed to the Chairman of the Tramways Committee and delivered at the Town Clerk's office before Noon on Monday, the 22nd August.

The Corporation do not bind themselves to accept the lowest or any Tender.

By Order,
T. THOMAS.
Guildhall, Hull,
3rd August, 1927. 6165

Macfarlane and Robinson, LIMITED,
BUSHBURY WORKS,
WOLVERHAMPTON,

INVITE TENDERS for the WHOLE of their PLANT and MACHINERY, TOOLS and other Effects, comprising Deep Stamping and Drawing Presses, Spinning Lathes, Circling and Cutting Machines, Travelling Conveyors, Grinding Mills, Spot Welders, &c.

Inspection at the works invited by arrangement.

Apply, SECRETARY. 6098

North Darley Urban District COUNCIL.

WATER SUPPLY FROM SYDNOPE.

The North Darley Council invite TENDERS from contractors for SINKING a WELL 48ft. deep and DRIVING 60 YARDS of TUNNEL in the Millstone Grit at Sydnope, and for PROVIDING and LAYING about 2¼ MILES of 6in. CAST IRON PIPE from Sydnope to Two Dales.

The plans and specification may be seen at the offices of the Engineers, Messrs. G. and F. W. Hodson, M. Inst. C.E., Bank Chambers, Loughborough, and copy of the schedule of works obtained from them on deposit of cheque for £5 5s., which will be refunded on receipt of a bona fide Tender and the return of the documents.

Tenders are to be sent to the undersigned not later than the 24th day of August, 1927.

The Council do not bind themselves to accept the lowest or any Tender.

Dated the 27th day of July, 1927.

F. C. LYMN,
Clerk to the Council.
Westminster Bank Chambers, Matlock. 6131

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PUBLIC NOTICES

Borough of Swindon.
CONSTRUCTION OF STEEL BUILDINGS.

The Corporation of Swindon invite TENDERS for the CONSTRUCTION of STEEL BUILDINGS and INTERNAL FINISHINGS for their new Electricity Works at Moredon, near Swindon.

The buildings will consist of a steel frame covered with Robertson's protected metal sheeting and will be erected on foundations already provided.

Specifications, forms of Tender, and drawings may be obtained from Messrs. Preece, Cardew and Rider, 8, Queen Anne's-gate, Westminster, S.W. 1, on payment of a deposit of £5 5s., which will be refunded on receipt of a bona fide Tender within the prescribed time.

Extra copies of the specification may be obtained on payment of One Guinea per copy, which will not be returnable.

Sealed Tenders, endorsed "Moredon Power Station, Tender for Buildings," must be delivered to me at my office not later than 10 a.m. on Saturday, 27th August, 1927.

The lowest or any Tender will not necessarily be accepted, and the Corporation will not consider any Tender which is not in accordance with the specification.

Tenders from bona fide constructional steel work engineers only will be considered.

By Order,
ROBT. HILTON,
Town Clerk.

Town Hall, Swindon,
2nd August, 1927. 6129

State Electricity Commission
OF VICTORIA,
22-32, WILLIAM STREET, MELBOURNE, AUSTRALIA.

TENDERS are hereby INVITED for the MANUFACTURE, SUPPLY and DELIVERY for the Yallourn Brown Coal Works, Victoria, Australia, of EIGHT TUBULAR STEAM COAL DRIERS, SEVEN ELECTRICALLY OPERATED BRIQUETTE PRESSES, and a CENTRAL WASTE COAL DUST COLLECTING SYSTEM, in accordance with Specification No. 27/42.

Copies of Tender forms, specification, &c., will be available upon application to :—

The Agent-General for Victoria,
Victoria House, The Strand,
London, England.

CHARGE.—£3 3s. for three copies of Tender form, conditions of contract, specification and drawings complete. This charge will be returned in the event of a bona fide Tender being received. Extra copies £1 1s. each, not returnable.

PRELIMINARY DEPOSIT.—A preliminary deposit of £100 is to be lodged at the office of the Agent-General for Victoria.

Tenders, on prescribed forms, properly endorsed and addressed, must be delivered at the office of the Commission, Melbourne, not later than 28th November, 1927.

The Commission does not bind itself to accept the lowest or any Tender.

W. J. PRICE,
Acting Secretary.

6058

The Bengal and North-Western
RAILWAY COMPANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

384 PAIRS WHEELS and AXLES for WAGONS, as per specification to be seen at the Company's offices.

Tenders, addressed to the undersigned and marked "Tender for Wheels and Axles," with name of firm tendering, to be lodged not later than Noon on the 24th day of August, 1927.

For each specification a fee of £1 will be charged, which cannot under any circumstances be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
W. R. IZAT,
Managing Director.

237, Gresham House, Old Broad-street,
London, E.C. 2, 3/8/1927. 6160

West Ham Union.
TO LAUNDRY ENGINEERS.

The Guardians invite TENDERS for the SUPPLY and FIXING of ONE 225-SHIRT MACHINE and ONE 4-ROLL IRONING and FINISHING MACHINE for their Forest Gate Sick Home, Forest-lane, Forest Gate, E. 7.

Persons and firms desirous of tendering should forward specifications and full information as to the machines they propose to supply, and the Tenders must be delivered to the undersigned not later than 10 a.m. on Thursday, the 11th August, 1927.

L. E. FRAQUET,
Clerk.

Board Room, Union-road,
Leytonstone, E. 11,
28th July, 1927. 6135

Commissioners for the Port of
RANGOON.
WANTED, ASSISTANT CIVIL ENGINEER.

The Commissioners invite APPLICATIONS for APPOINTMENT of an ASSISTANT CIVIL ENGINEER on agreement for 3 years, with prospect of subsequent transfer to permanent establishment on approved service, should a vacancy occur. Salary Rs. 700 per mensem, rising by annual increments of Rs. 40 to Rs. 900, with motor cycle allowance of Rs. 50 p.m. Applicants must be British subjects between 25 and 30 years of age, single, with good general, preferably Public School, education ; should be Chartered Civil Engineers who have passed the Associate Membership Examination of Institution of Civil Engineers and with not less than two years' practical experience on Port or Harbour Work since completion of indenture or equivalent training.

Written applications only will be entertained, and these, with references and copies of testimonials, should be addressed, not later than the 25th August, to COMMISSIONERS' CONSULTING ENGINEERS, Sir Alexander Gibb and Partners, Queen Anne's Lodge, Westminster, London, S.W. 1, from whom full particulars regarding the appointment may be obtained.

6145

Commissioners for the Port of
RANGOON.
WANTED, MECHANICAL ENGINEER.

The Commissioners invite APPLICATIONS for APPOINTMENT of MECHANICAL ENGINEER on agreement for 3 years, with prospect of subsequent transfer to permanent establishment on approved service. Salary, Rs. 1050 per mensem, rising by annual increments of Rs. 50 to Rs. 1150, plus overseas pay Rs. 250 p.m., executive allowance Rs. 100 p.m., and Rs. 150 motor car allowance p.m. Applicants must be British subjects, about 35 years of age, with first-class, preferably Public School, education ; should be Members or Associate Members of Institution of Mechanical Engineers, with experience in Management and Practice of Modern Workshops, as applied to upkeep of Marine and Port Equipment on large scale.

Written applications only will be entertained, and these, with references and copies of testimonials, should be addressed, not later than 25th August, to COMMISSIONERS' CONSULTING ENGINEERS, Sir Alexander Gibb and Partners, Queen Anne's Lodge, Westminster, London, S.W. 1, from whom full particulars regarding the appointment may be obtained.

6146

Borough of Ossett.
WATERWORKS DEPARTMENT.
ENGINEER.

APPLICATIONS are INVITED for the POSITION of ENGINEER to Take Charge (under the supervision of the Waterworks Engineer) of the Pildacre Pumping Station and Softening Plant.

Wages £5 per week.

Applications, giving full particulars of present employment, age and experience, accompanied by copies of not more than three recent testimonials, to be sent to the undersigned, endorsed "Engineer," not later than Saturday, the 13th August, 1927.

T. W. WILSON,
Town Clerk.

Town Hall, Ossett,
29th July, 1927. 6126

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED by Old-established Firm in India, SALESMAN for Railway Requirements. Age not over 24.—Reply, giving fullest details educations, training, experience, present work and salary, to "Z.P. 806," c.o. Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 6140 A

WANTED for India, ENGINEER SALESMAN, Conversant with Air Compressing and Pneumatic Plant for Mining and Workshop Use ; age not over 28 ; must be single. — State fullest details of education, experience, present work and salary, to Z.R. 807, c.o. Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 6141 A

WANTED, RATE-FIXER for Small Works on North-East Coast ; experience of Gear Cutting and Machine Work generally essential.—Address, stating age, experience, salary required and when at liberty, 6132, The Engineer Office. 6132 A

WANTED, YOUNG ENGINEER, Bachelor of Science, with workshop training, for POST in Calcutta.—Address, 6091, The Engineer Office. 6091 A

BLAST-FURNACE MANAGER.—An ASSISTANT REQUIRED. Must be competent, practical man, used to control of Hematite Blast-furnaces, with a thorough grasp of the process and used to handling men.—Apply, with full particulars as to age, qualifications, experience, and salary required, to SECRETARY, Consett Iron Co., Ltd., Consett, Co. Durham. 6164 A

LARGE ENGINEERING FIRM, Experimentally developing mechanisms presenting some problems as faster types of Printing Machinery, Rotary Presses, &c., REQUIRES ASSISTANCE of DRAUGHTSMAN-DESIGNER. Applicants should have high educational qualifications and practical experience.—Address, 6150, The Engineer Office. 6150 A

SITUATIONS OPEN (continued)

LARGE and Old-established FIRM of Constructional Engineers in India REQUIRE a thoroughly capable STRUCTURAL DRAUGHTSMAN. Age not over 25, unmarried.—Reply, giving fullest details education, engineering experience, present class work and present salary, to Box "Z.N. 783," c/o Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 6154 A

PATENT AGENT'S ASSISTANT WANTED for Legal and Technical Department of Engineering Firm ; salary four hundred per annum.—Address, giving technical experience and age, P3485, The Engineer Office. P3485 A

SHOP SUPERINTENDENT WANTED for Works producing Heavy Machine Tools, Manchester district. Highest class of man required, who must be energetic and progressive. State age, experience, and salary required.—Address, 6169, The Engineer Office. 6169 A

WIRE ROPE WORKS, Specialising in Locked Coil and Flattened Strand Constructions, REQUIRE expert SUPERINTENDENT with practical experience in these lines. State experience, age, and salary required.—Address, 6161, The Engineer Office. 6161 A

WANTED, a SENIOR DRAUGHTSMAN, with Good experience in the Motor Car Trade and with special ability in checking drawings.—Address, quoting references and salary required, 6095, The Engineer Office. 6095 A

DRAUGHTSMAN, General Engineering, Technical College-shop trained, capable of Designing Simple Steel Structures, unmarried, REQUIRED for Straits Settlements. Salary £38 per month, rising by annual increments of £3 per month, four years' agreement, passage out and home. Applications, stating age, qualifications and experience.—Address, "TUKANG," Wm. Porteous and Co., Advertising Agents, Glasgow. P3487 A

SITUATIONS OPEN (continued)

WANTED IMMEDIATELY, DESIGNER for London Firm of Structural Engineers. Must be accustomed to Cinema and London Building Work.—Address, stating experience, salary required, &c., P3491, The Engineer Office. P3491 A

CAPABLE MECHANICAL DRAUGHTSMAN REQUIRED, with good general and theoretical training.—Write, stating age, experience, and salary required, to "Z. 370," c/o Deacon's, Fenchurch-avenue, E.C. 3. 6156 A

DRAUGHTSMAN (JUNIOR), with Pumping Machinery experience, REQUIRED for East Midlands. State experience, previous employers, age, salary required.—Address, 5997, The Engineer Office. 5997 A

DRAUGHTSMAN REQUIRED IMMEDIATELY. Must have had previous experience complete steam-raising Plant.—Apply, stating salary required, JOHN THOMPSON WATER TUBE BOILERS, Ltd., Wolverhampton. 6167 A

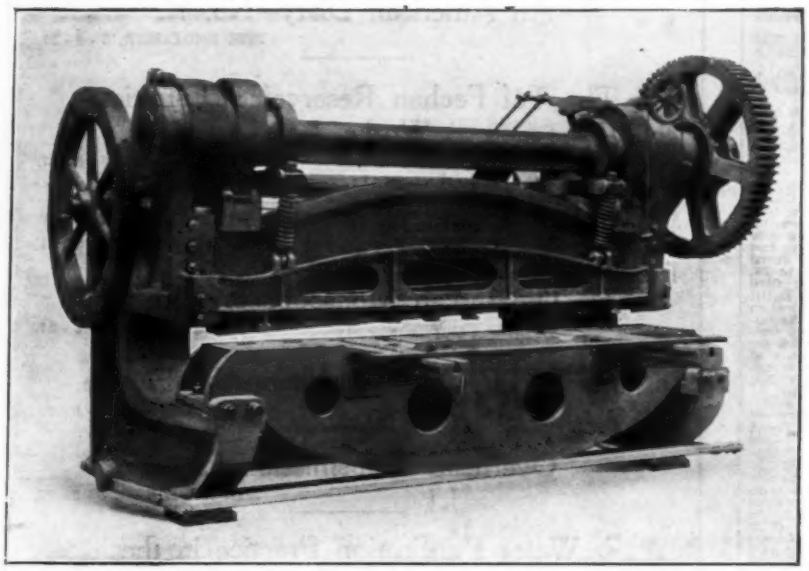
DRAUGHTSMAN WANTED, with Good Experience in Elevating and Conveying Plants. Only first-class men with initiative need apply.—Write, giving full particulars of experience, to W. J. JENKINS and CO., Ltd., Beehive Works, Retford, Notts. 6166 A

DRAUGHTSMEN, with Experience of Electric Cranes, preferably Jib Cranes, or Haulage Gears.—Apply, giving full particulars of experience, wages, age, when free, CHIEF DRAUGHTSMAN, John M. Henderson and Co., Ltd., King's Works, Aberdeen. 6168 A

DRAUGHTSMAN REQUIRED, London District, man thoroughly conversant with Design of Plant for the Pressing and Stamping out of Sheet Metal.—Address, P3482, The Engineer Office. P3482 A

For continuation of Small Advertisements see page 3.

MODERN GUILLOTINE SHEARING MACHINES



With Clutch Stop-Motion and Automatic Plate Holder.

Illustration shows 8′ 0″ × 7/16″ Machine.

Multiple Punching Machines.

With Automatic Spacing, Edge Shearing Attachment, Butt Shearing Attachment, and Patent Curved Line Motion for Shell Plates with Sheer.

Pneumatic Riveters.

More than 90 Patterns for all Purposes.

DE BERGUE & Co. LTD. MANCHESTER.

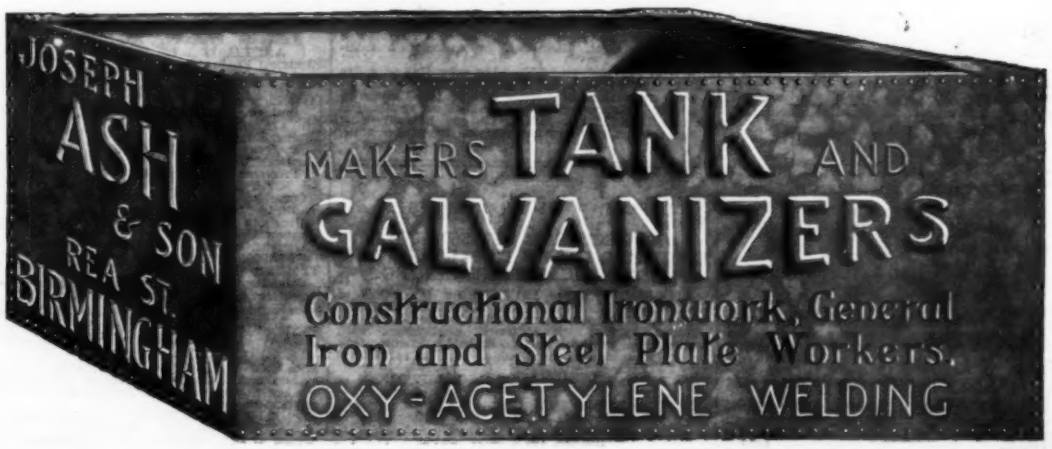
JOHN OAKEY & SONS, LIMITED,
MANUFACTURERS.

GENUINE EMERY.
EMERY CLOTH.
EMERY, CORUNDUM, GARNET & FLINT TAPE
GLASS PAPER, BLACK LEAD.

FLINT AND GARNET PAPER.
N.B.—All Papers and Cloths are supplied in Rolls, Bands, Discs, Strips, and Sheets of almost any size and shape, to suit the special requirements of buyers. Prices quoted on receipt of particulars.

EMERY AND CORUNDUM DISCS
Of Cloth & Paper, for all Disc Grinding & Polishing Machines.
EMERY WHEELS

WELLINGTON WORKS, WESTMINSTER BRIDGE ROAD, LONDON, S.E. 1.



A Seven-Day Journal

The Gun Armament of Cruisers.

So far as technical questions are concerned, the Geneva Naval Conference may be said to have been dominated by the 8in. gun. For reasons that are not entirely clear, the American naval authorities have conceived a strong partiality for this gun as a cruiser weapon, and they wish to mount it in all their future cruisers. On these grounds they have hitherto resisted the British proposal to reduce the standard displacement of cruisers from 10,000 tons to 7500 or even to 6000 tons. British naval opinion, on the other hand, regards the 6in. gun as an adequate armament for cruising ships. The fact is that prior to the Washington Conference all save five of the cruisers, built and building, in the British and foreign navies were armed with guns of 6in. calibre or less, the only exceptions being our ships of the "Raleigh" class, which carried 7·5in. guns. If, however, the 6in. gun is to be superseded by the 8in. as the standard armament for cruisers, the displacement of these ships must necessarily be large and their cost proportionately heavy. It is interesting to learn from the latest British proposals at Geneva that H.M.S. York, the first of the "B" class cruisers, with a displacement of about 8000 tons, is to be armed with 8in. guns. The number will probably be limited to six, as in the Japanese "Furutaka" class, which has a displacement of 7100 tons.

The Eight Hours Day in Germany.

By an order dated July 18th last, the German Minister of Labour has decreed that, after January 1st next, the eight hours day shall become the rule in the German metallurgical industry. The decision is not in accordance with the views of the employers, who wished the question to be adjourned till 1930. The workmen's organisations would have liked the change to date from August 1st this year, but they are well contented with the revision of the law passed in December, 1923, which legalised a ten hours working day, limited to twelve hours overall, with two hours for rest and meals. It should be noted that this law was abrogated, so far as blast-furnaces and coke ovens were concerned, on April 1st, 1925, when the eight-hour day was re-established in these industries. By the new ordinance the eight-hour day will apply to ironfoundries, steel works, electric furnaces, rolling mills, forges, &c. Overtime, of half an hour only, will be authorised in exceptional circumstances. The action of the Minister is possibly due to a desire to avoid extensive troubles in the industry, for agreements with the employers are now under discussion, and there may have been a fear that the strike at Cologne, which has now lasted for several weeks, would become general.

Standardising London's Electricity Supply.

The change-over, in the early hours of Monday morning, August 1st, of a large area in the West of London from the different voltages of the supply companies to a high-pressure standard distribution voltage of 20,000, marks an important step towards the standardisation of London's electricity supply services. As was natural, a good deal of preparatory work had to be done by the engineers before all was ready for switching-in, and that work involved the laying of new high-pressure cables and the provision of the necessary switchgear and transformers. The night before Bank Holiday was chosen as being a time when the load on the distributing mains would be at a minimum. We learn that the switching-over took place without the slightest hitch. In the area affected the mains of the various supply authorities are now interlinked, so that the distributing companies can take power in bulk from central generating stations. The change which has been made in West London is only part of a larger scheme for economic distribution which will be carried out throughout the country under the direction of the National Electricity Board.

Port of London Improvements.

At a meeting of the Port of London Authority, which was held on Thursday last, July 28th, it was agreed to entrust to Sir Robert McAlpine and Sons the work of carrying out the second part of the scheme for improving the West India and the Millwall docks. The new work will embrace the construction of a new entrance lock to the South-West India Dock, with a length of 590ft. and a width of 80ft. It will be recalled that the first part of the scheme involved the cutting of interconnecting passages between the hitherto separate West India Import and Export docks and the Millwall Docks. That work is now in an advanced state, and when it is completed there will be accommodation in the system of docks referred to for much larger vessels than can at present be dealt with. Work on the new Tilbury Dock, the construction of which is also being carried out by Sir Robert McAlpine and Sons, is also being hastened, and it is anticipated that the dock will be completed a full year ahead of the contract time. Another improvement decided upon by the Authority, the announcement of which was made last week, is the building of three specially designed storage sheds for soft wood at the Surrey Commercial Docks. They will be erected by John Mowlem and Co., Ltd., and will accommodate 8200 standards, or 20,500 tons, of timber.

The Quadruple-Screw Motor Liner Bermuda.

The quadruple-screw motor passenger liner Bermuda, which was successfully launched from the North Yard of Workman, Clark and Co., Ltd., at Belfast, on Thursday of last week, July 28th, promises to be a vessel of unusual interest, because of her newly designed Doxford propelling machinery. The Bermuda, which has been constructed to the order of the Bermuda and West Indies Steamship Company, Ltd., an associated firm of Furness, Withy and Co., Ltd., has been built for service between New York and Bermuda and also designed for world cruises. She has a length of 550ft., a beam of 74ft., and a depth of 45ft. to the shelter deck, with a displacement of about 20,000 tons and a gross tonnage of about 17,000. Seven decks are set apart for passenger accommodation, besides which there are holds for both general and refrigerated cargo. The propelling machinery comprises four sets of Doxford opposed-piston oil engines designed for a total output on trial of 13,500 S.H.P. Each unit has four cylinders with a bore of 600 mm. and a combined stroke of 1800 mm. The normal output of each set is rated at 2800 to 2900 B.H.P. when running at speeds from 110 to 112 r.p.m. In getting out the design special care was given to the balancing of the engines with a view to avoiding vibration. Instead of a 4 : 1 stroke bore ratio a 3 : 1 ratio has been employed in the case of the Bermuda's engines, and the two pistons have different strokes, that of the upper piston being 760 mm. and that of the lower 1040 mm. During the recent bench trials the engines were found to run remarkably smoothly and a fuel consumption of 0·38 lb. per B.H.P.-hour was repeatedly recorded, so the makers inform us, on the forty-eight hours' and the successive twelve hours' continuous trials.

An Aeroplane Flight from a Liner.

What is claimed to be the first aeroplane flight made from a passenger liner was successfully completed by Mr. Clarence Chamberlin on Monday last, August 1st. The vessel chosen for this experimental flight was the liner Leviathan, of the United States Lines, which left New York shortly after midnight on Sunday evening. A special runway was constructed on the boat deck of the ship and Mr. Chamberlin took off at 8.15 a.m. on Monday morning, when the vessel was abreast of Fire Island. Two destroyers had accompanied the ship from New York and they turned and followed Mr. Chamberlin as he flew towards the shore, in readiness to offer assistance in case of accident. Mr. Chamberlin, who had intended to make for St. Petersburg, New Jersey, was compelled by fog to descend at Curtiss Field, which he reached at 10 a.m. The flight is of technical interest because some of the new French and Italian Transatlantic liners are to be equipped to carry one or more aeroplanes, and it is stated that similar provisions will now be made on American ships in the Atlantic or Pacific services. As yet there has been no suggestion that a special aircraft-carrying mail steamer should be employed, but it will be recalled that such a vessel was described in a paper which was read at the 1923 spring meetings of the Institution of Naval Architects by Sir Eustace d'Eyncourt and Mr. John Narbeth. Plans of that proposed mail steamer will be found in The Engineer for March 23rd, 1923. There is little doubt that in the near future we shall see combined steamship and aeroplane services, both for the more expeditious delivery of mails and for passenger use in particular cases.

Hours of Labour in Germany.

The results of the inquiry into hours of labour in Germany which was carried out during the last week in April by the German Federation of Socialist Trade Unions have now been published. The inquiry covered 2,523,147 workers in 57,895 establishments, the industries included being the building, woodworking, metal working, printing, chemical, shoemaking, and textile trades. Of the number of workmen included, 4·6 per cent. were on short time, 6·3 per cent. had a working week of less than forty-eight hours, 41·1 per cent. worked a forty-eight hour week, 10·5 per cent. from forty-eight to fifty-one hours, 25·2 per cent. from fifty-one to fifty-four hours, and 12·3 per cent. worked a longer week than fifty-four hours. It will be seen that 48 per cent. of the workers were working more than forty-eight hours per week, as compared with 45·4 per cent. at the corresponding inquiry in November, 1924. The numbers working more than fifty-four hours per week had also risen from 10 per cent. to 12·3 per cent. Considered by industries, and comparing the figures at the two inquiries, the numbers of employees working more than forty-eight hours per week had risen in the building trades from 10·5 to 12·6 per cent., in the chemical industries from 38·8 to 45·5 per cent., in the metal industries from 53 to 57·4 per cent., in the textile industries from 66 to 75·2 per cent., and in the shoe trades from 8·1 to 8·4 per cent. On the other hand, in the printing trade the employees working more than forty-eight hours per week had dropped from 26·5 to 9·5 per cent., and in the woodworking industries from 15·6 to 12·6 per cent. The Rhineland and Westphalia headed the list of areas as regards length of working hours, 79·2 per cent. of the employees exceeding a forty-eight hour week.

The New S.O.S. Distress Signal.

It is announced that in future the S.O.S. distress signal for ships will, throughout the world, be preceded by three long dashes, each of four seconds duration. This change in signal has been brought about by the approval by the Board of Trade of an auto-alarm device, which automatically receives the three long dash signal and rings a bell in the wireless room, on the captain's bridge, and in the engine-room, summoning the wireless operator to his post to take the actual distress message. Two types of automatic alarms have been designed by the Marconi Company and the Radio Communication Company, Ltd., and have received the approval of the Board of Trade and the Postmaster-General. The apparatus, we are informed, comprises a comparatively small addition to a ship's standard wireless equipment, and during trials which have been made within the last three months it has been shown to be unaffected by climatic changes such as are met with in marine service. A recent Board of Trade regulation makes the fitting of an auto-alarm device compulsory on certain classes of vessels on which a permanent telegraphic watch is not kept. During the next twelve months all ocean-going ships carrying between 50 and 200 persons, also coasting vessels which carry 50 persons or more, and which have a duration of voyage from port to port exceeding eight hours, will be fitted with automatic alarm apparatus of the type referred to.

Richardsons, Westgarth and Co., Ltd.

The report of the directors of Richardsons, Westgarth and Co., Ltd., which was made public during the past week, shows that the results for the year ended December 31st, 1926, are less unfavourable than might have been expected, when the interruption of work caused by the coal strike, the scarcity of marine engine orders, and the low prices which ruled throughout the year are taken into account. Since the close of the period under review orders for internal combustion and steam engines have been obtained which has made it possible to reopen both the Middlesbrough and Sunderland works of the firm. Appreciable progress has been made, we learn, towards the commercial stage of manufacture of the company's new double-acting two-stroke marine oil engine. The power plant and electrical departments are also busy, and an agreement has recently been entered into with Brown-Boveri and Co., of Baden, Switzerland, whereby Richardsons, Westgarth and Co., Ltd., are given the exclusive right to manufacture steam turbines and electrical generators of the Brown-Boveri type in this country.

A New All-Metal Flying Boat.

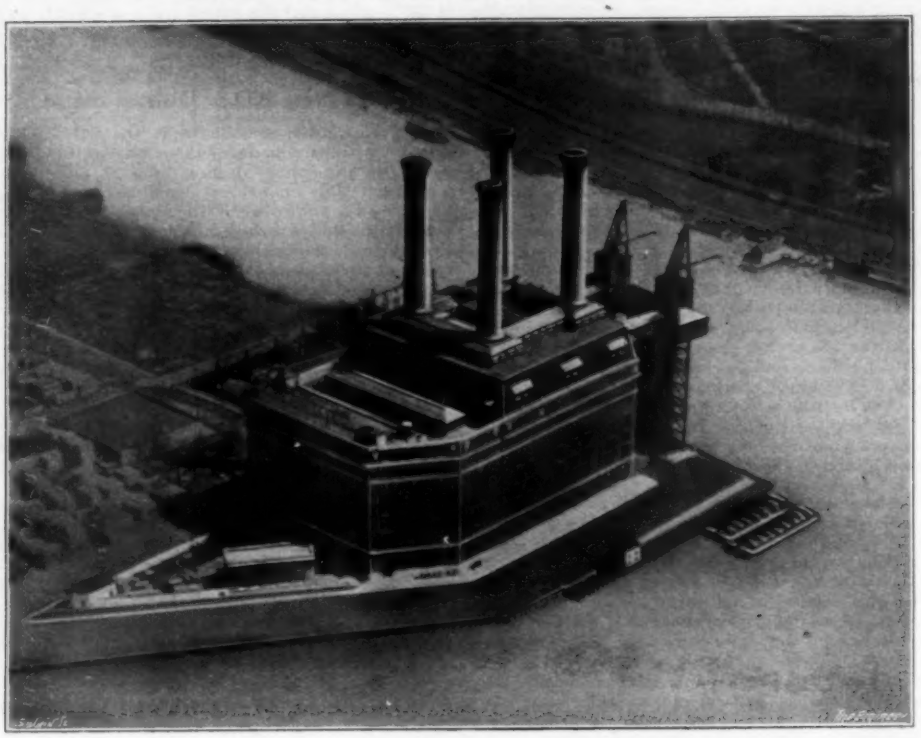
On Tuesday of this week, August 2nd, the new all-metal flying boat Iris II. was successfully launched from the Brough seaplane base of the Blackburn Aeroplane Company, Ltd., on the Humber, and underwent preliminary trials. She has been built to the designs of Major Rennie, and will be used for naval reconnaissance work. The new boat is driven by three "Condor" Rolls-Royce engines of 700 horse-power each, and it is stated that she will take off from the water for flight at a speed of 50 knots. She differs principally from her sister ship Iris I. in that she has an all-metal hull, which is not only lighter, but will avoid water soakage. In the new boat there is a navigator's cockpit, with separate accommodation for the wireless operator, along with bunk accommodation for a crew of five persons. The boat carries her own supplies of fresh water and electrically heated cooking appliances are fitted. After cruising inland, the new flying boat was anchored at Brough. We understand that she is designed to remain in the air for periods up to 14 hours, and is so constructed that she can equally well cruise on the water or remain at moorings for nine months in the year.

The Clyde Riveters' Strike.

At meetings which were held at Govan and Clydebank on Wednesday last, August 3rd, it was decided to terminate the unofficial strike of Clyde riveters against the new price list and to return to work on the following day, Thursday. The unofficial and unconstitutional character of the dispute has been recognised throughout by the Executive Committee of the Boilermakers' Society, and it was largely as a result of instructions sent to the Clyde area by that body that the decision to return to work was come to. The Shipbuilding Employers' Federation has kept in close touch with the men's Executive Committee, and it is understood that now the men have returned to work the recognised procedure for discussing differences of opinion can be put into operation, and that the matters arising out of the new price list and its application will receive the consideration of the employers at an early date.

SHERMAN CREEK POWER STATION

THOMAS E. MURRAY, INC., CONSULTING ENGINEERS



An American Diary.

No. II.*

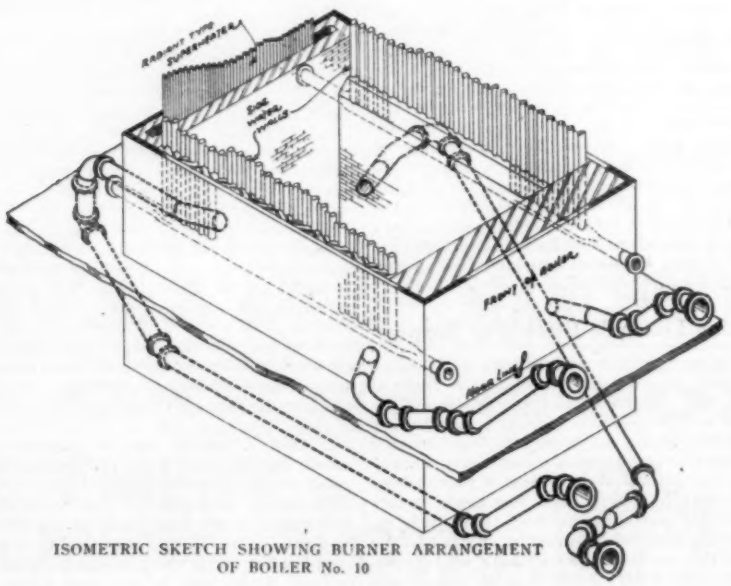
Sherman Creek.

To the technical visitor the station which stands at the corner where the Harlem River and Sherman Creek meet is, although a good deal older, for the first units were started in 1913, even more interesting than Hell Gate; moreover, it is rather attractive to look at, as the reader may judge from the view given above. It is built on 8000 wooden piles, the tops of which are embedded in concrete. No less than 16,000 tons of structural steel and something like 8,000,000 bricks are contained in the superstructure. It should be noticed that, like relatively few modern stations, it has brick stacks. There is a characteristic about the chimneys of all these very lofty boilers. Whilst boilers were low it was natural to build chimneys up from the ground, but when the uptake is 70ft. or 80ft. up in the air that would be a very uneconomical arrangement. The stacks at Sherman Creek, and indeed all recent stations, are carried on steel girders, and in this case the "foundations" are exceptionally high because the boilers are built in two tiers. Their external bases, which can be seen in the view, are nearly 240ft. above ground level and the height to their summit is 325ft.

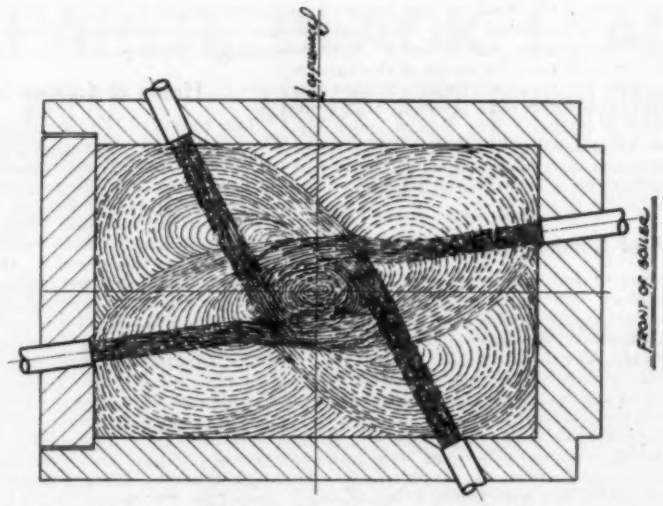
We need not stay long over the coal-handling equipment, which is somewhat similar to that at Hell Gate, but the ashes, instead of being waterborne, as at that station, are dropped into steel cars hauled by an electric locomotive, and are conveyed to a hopper from which they are raised to a larger hopper, whence they descend by gravity into ash scows or trucks. We may, also, pass over forty-four out of the sixty boilers, for they are ordinary Babcock and Wilcox generators for a gauge pressure of 200 lb., and the stokers are ordinary Taylor underfeeds, like those at Hell Gate. Each boiler has 6280 square feet of heating surface and 943 square feet of superheater surface. The remaining boilers are much more interesting, because they are fitted with a variety of arrangements for burning powdered fuel. All six are of the Springfield type—that is, with one cross drum. They, also, have 6280 square feet of heating surface each, with 430 square feet of water side walls, but only 235 square feet of superheater surface. The pressure is 225 lb. The superheater is quite different from any we have so far considered. It is of the radiant-heat type and is virtually a gridiron of tubes on the back wall of the furnace. Each unit consists of a long hairpin of $1\frac{1}{4}$ tube.

Four of these six boilers are provided with powdered coal from a storage bin, whilst the other two have unit pulverisers. In America, as indeed in this country, one may hear long discussions about the relative merits of the two systems. The bin system has certain disadvantages which everyone sees, but some people hold that the unit system can never be developed up to really big sizes. That view is not universally held, and one station is already making preparations to use a unit pulveriser for a very large boiler. No actual figures for that system are available, but it may be of interest to give a couple for the bin system which were picked up in conversation and appear to be pretty generally accepted. They are, 2 dollars per kilowatt for capital cost—investment, as it is called in America—and 23 cents per ton for operation. There is another figure which it is easy and useful to remember. As a round number it may be taken that these great power stations cost 100 dollars per kilowatt. Some are as low as 80 dollars and some higher than 100. But taking 100 dollars as a pretty fair average, their powdered fuel plant—bin system—complete costs, it will be seen, about 2 per cent. of the whole. A stoker equipment costs less by a small amount. Which of the two, when all things are considered, is the more economical no one seems prepared to say with absolute certainty, and the real turning point which tips the beam in favour of powdered coal is, with equal qualities of coal, the ease of manipulation. The rate of evaporation can be changed with great rapidity, and, moreover, in emergency a furnace can be shut down instantly, and as there is no fire on the grate evaporation soon stops. With one of the troubles presented by powdered fuel which has been minimised by its advocates, the dust emission, we shall have more to say as our journal proceeds.

Let us return now to the powdered fuel boilers at Sherman Creek. One arrangement that is to be seen is the use of nine burners, three high, three wide, in the boiler front. The dust is blown in by about one-third of the total air required. In another, of the so-called forced-draught type, the primary air and coal are fed in together at the centre of the burner, and the secondary air is admitted by an annulus round the burner. In another all the air required is admitted with the coal. In that case the powdered fuel drops over a lip into the stream of air. The last type is quite



ISOMETRIC SKETCH SHOWING BURNER ARRANGEMENT OF BOILER No. 10



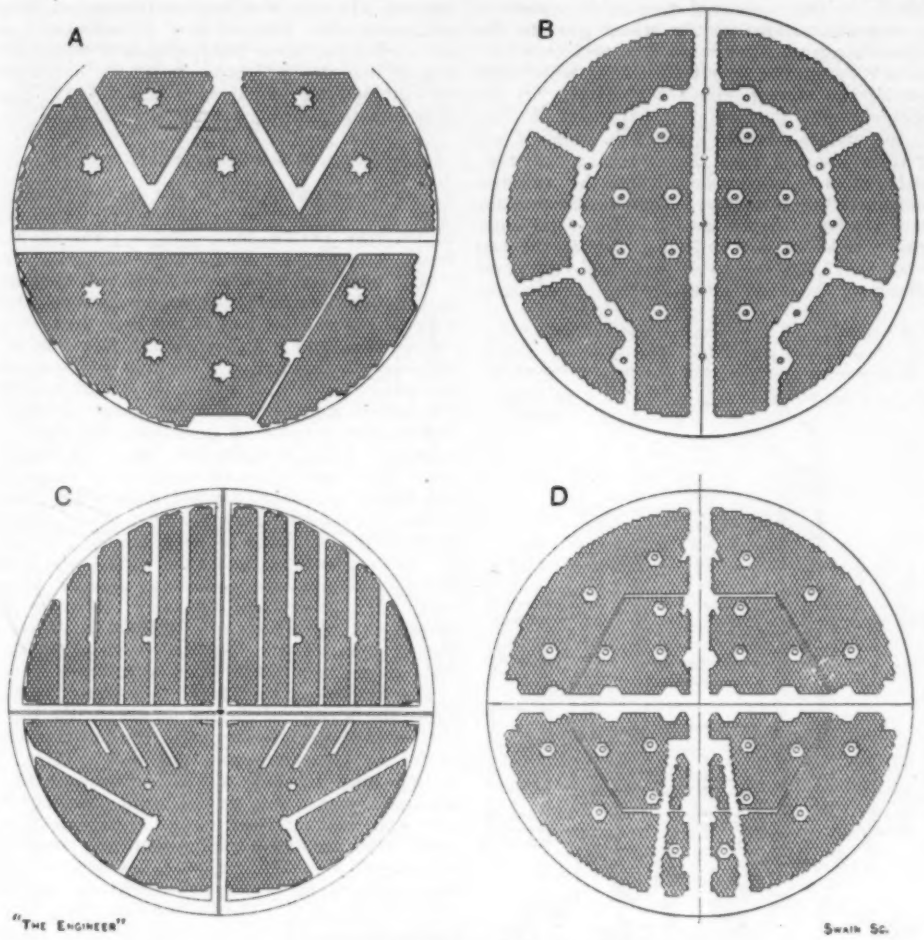
PLAN SHOWING BURNER ARRANGEMENT OF BOILER No 10

"THE ENGINEER"

EXPERIMENTAL POWDERED FUEL ARRANGEMENT AT SHERMAN CREEK

* No. I. appeared July 29th.

different, and is shown by the annexed sketches. The object sought is to obtain a whirling action, as in the Wood radiant heat boiler. The sketches make verbal description unnecessary. At Sherman Creek there are six 60-cycle and two 25-cycle turbo-generators. They are all single-cylinder machines, by Westinghouse. Three, which took up load in December, 1913, develop 15,000 kW at 1800 revolutions per minute. Steam enters at the centre, passes through two impulse stages, and then passes to right and left through reaction stages. Two years later they were followed by two 25-cycle, 20,000-kW, 1500-r.p.m. machines. As before, the steam enters at the centre and passes through a two-row impulse stage, but it then flows through a single flow reaction section and only then turns right and left through the low-pressure double-flow sections. The latest machines are of the same general design, but generate 22,000 kVA at 1800 r.p.m. The best consumption is in the neighbourhood of 12·5 lb. of steam per kW.hr., with a steam pressure of 185 lb. and 100 deg. of superheat.

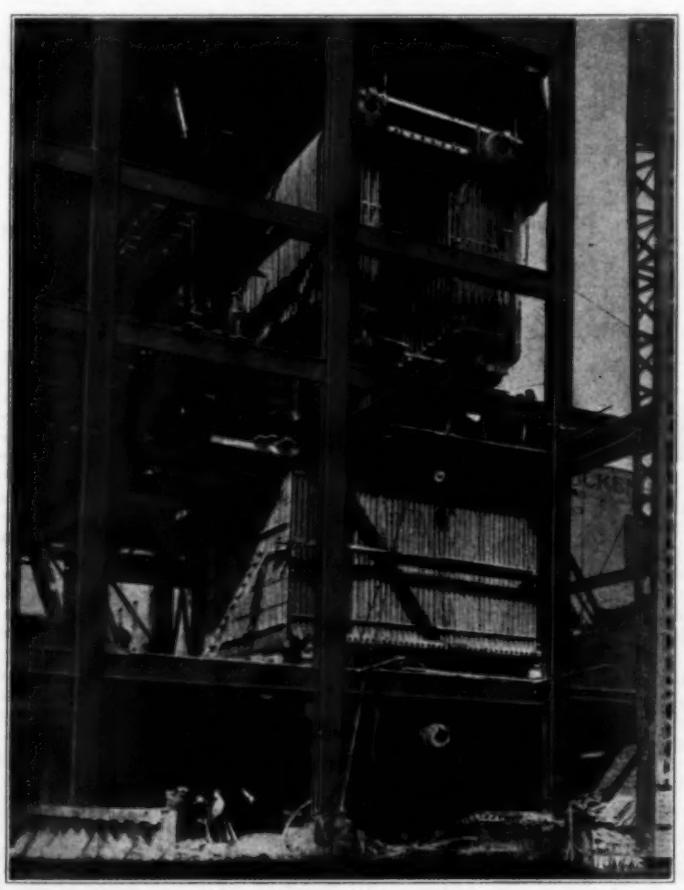


TYPICAL CONDENSER TUBE PLATES

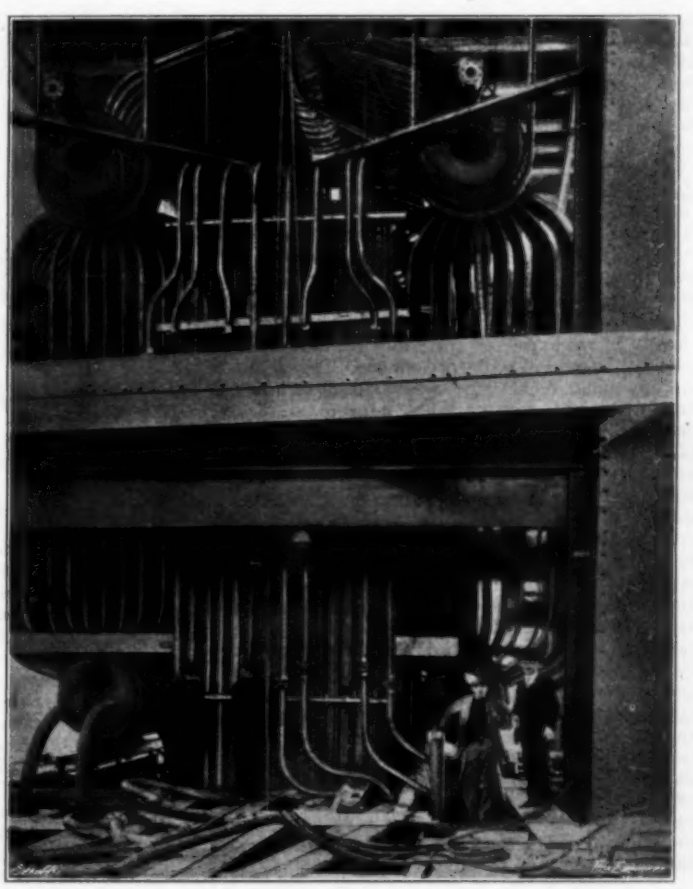
Condensers.

A brief allusion has already been made to the condenser problem in America, and more will have to be said about it as we proceed, but it may be of interest to give now a series of sketches which show the arrangement of tubes in the condensers at Hell Gate and Sherman's Creek. In these sketches the tinted areas show the section occupied by the tubes, whilst the clear areas indicate open passages between the tubes. A is the condenser for the 1913 units at Sherman Creek. There are 5471 tubes, 1in. diameter and 15ft. long. It is of the parallel two-flow type. The cooling water amounts to 24,000 gallons per minute. B shows the other type at Sherman Creek. Here the arrangement is radial flow, two pass—the condenser being divided longitudinally. The largest size has 40,000 square feet in 1in. tubes 17ft. 2½in. long, and 50,000 g.p.m. of cooling water are required. Both these condensers are by Westinghouse. C shows the condenser tube plate for a 35,000 kW machine at Hell Gate—Worthington. It is a two-pass condenser, with 50,000 square feet of tubes, and the two circulating pumps deliver each up to 35,000 g.p.m. of water—salt in this case. The 40,000 kW machines at Hell Gate have condensers—Westinghouse—of the same size, but they are arranged for radial flow—see D—and the largest unit has a similar design, but with 63,000 square feet and 90,000 g.p.m. of circulating water. In all cases the condensers have divided water-boxes, with small doors in each half of the big units, so that cleaning can be carried on without shutting down. The best modern practice appears to be to bolt the condenser firmly to the exhaust opening, and then take the weight on springs or jacks, but at Sherman Creek a copper expansion joint is used.

In all stations an effort is made to avoid, as far as possible, overcrowding of the mass of auxiliary machinery below the turbine floor. Some stations are better than others, but in all, free use is made of steel structures to support the turbines, as they occupy less room than concrete masses.



KIP'S BAY, BOILER COMPLETE AND READY FOR UPPER SIDE SCREENS



KIP'S BAY, BOILER LEVEL, SHOWING BOILER DRUMS

The Graybar Building.

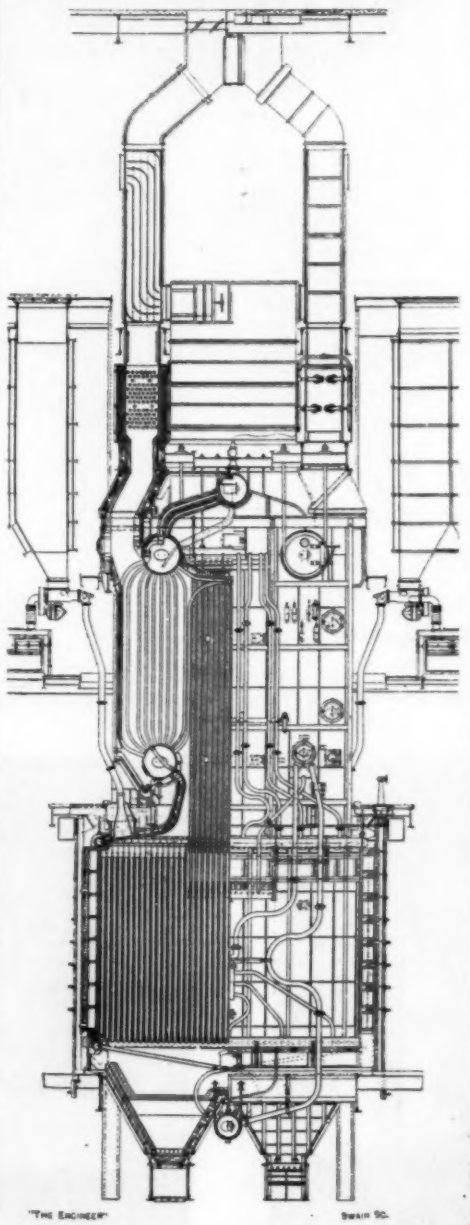
Twenty-three years ago, New York had a patchy appearance. Here and there high new buildings

reared themselves into the air, towering above the puny fellowship of the old. Only at night were the incongruities blended into harmony by the general darkness and the local brilliance of the lighted offices. In those days one boarded a ferry and gazed in wonder at a sky-line, the like of which was to be seen nowhere else. Nowadays, there are so many lofty buildings, much higher than the old, that homogeneity has been restored. These vast erections no longer offend by standing out in single arrogance. There are too many of them for that; so many, indeed, that very soon one forgets their great height. Only when you stand on the summit of one and look down upon the true "little ole New York" below you, do you see how many, many more have yet to be built before the city of giants is complete. Some of these great blocks are simply ugly, there is no other word for it. Of recent years more attention has been paid to "ancient lights," and the upper stories are stepped back. The effect is often disastrous, the building looking like a series of cubes piled one on top of the other, symmetrically or unsymmetrically, as the case requires. As a rule, the best effect is secured when the block is tower-like in design; then it stands up with dignity, and as the architect is generally allowed to use his artistic feeling on the summit, the eye is satisfied and refreshed after the long succession of plain windows mounting one by one to the sky. The summits of many of these buildings are illuminated at night, and thereby hangs a tale. When one of them was opened, coloured flood lights played upon its summit, and to enhance the effect, clouds of steam were sent up. The city fire authorities had not been informed, and in record time—of course!—every fire appliance in the City of New York was hurtling noisily towards the conflagration! A useful advertisement no doubt!

It is, however, rather the interior of the buildings than their exteriors that interest the engineer, for such lofty structures demand special arrangements for heating, ventilating, and, above all, for transportation. It is said that in New York the population travels daily much further in a vertical direction than it does horizontally. It is only necessary to stand in some great office block, with its great array of elevators, and watch the crowds continually ascending and descending, to find that statement easy of credence. Consider, for example, the Graybar Building, one of the newest in the heart of New York, not yet indeed complete.

When we called there we were fortunate enough to find the engineer responsible for the design of the engineering equipment, Mr. Clyde R. Place, in his office, and saw all over it from top to toe in the best hands. It is said to be the largest single office block in the world, for it has a total net rentable area of 1,350,000 square feet and its estimated population is 12,000. It stands beside the Grand Central Station and is actually reared over the double-decked railway. It cost about four million pounds to build and its estimated weight is nearly 200,000 tons. In its construction 22,500 tons of steel were consumed. Figures of this sort are not very illuminating. Take something easier to grasp. It is thirty storeys high and is served by thirty-two Otis elevators of the very latest type. Some of these lifts are expresses and some are not, but all travel at a speed of 800ft. per minute. That sounds an appalling velocity at which to flick human beings up and down. What happens to one's insides? They suffer enough in ordinary 400ft. lifts; what must their fate be at 800ft.? Incredible as it may sound, the mechanism for acceleration and deceleration has been brought to such perfection that the traveller is unconscious of any movement at all. Let us suppose that he wants to travel no more than a couple of floors. He steps into the "car," takes his hat off if ladies are present, and before he has time to put it on again the doors are open and he is at his destination. This is no exaggeration. For short journeys there seems to be no appreciable time between the closing of the doors and the reopening of them, and there is nothing whatever to indicate the speed of ascent. One is just as unconscious of movement as the traveller in the shell which Jules Verne's scientist shot to the moon. All the lifts are operated by overhead winches, some situated in the seventeenth storey and others at the very summit of the building. The motors are fitted with a fascinating creep motion which adjusts the "car" automatically to the floor level. The control is absolutely automatic and the attendant does nothing whatever but open and close the gates. In our travels we saw many "elevator" equipments, but none so perfect as this.

The heating, ventilating, water supply, and lighting of such a vast building present a great subject for engineers, but the heating system is the most interesting of all. Not far away there is one of the New York heat stations. It supplies high-pressure —150 lb. to 160 lb.—steam through 8in. pipes to the building. Some of the steam goes to the machine room on the ground floor and some to a similar room on the seventeenth floor, which supplies all the storeys above that level. In the machine rooms the steam is expanded through reducing valves down to about 2 lb. pressure into big reservoirs and goes thence to the radiators, which are hung on brackets below the windows. Pumps maintain a vacuum so that the low-pressure steam is always in circulation. The total cubic capacity to be warmed to 70 deg. Fah. all the year round is 15,500,000 cubic feet and the total radiator surface is 140,000 square feet, very roughly



BOILER AT KIP'S BAY STEAM HEAT STATION

1 square foot to 100 cubic feet. It must be remembered that at times the temperature in New York is far away below freezing point. The condensate from the radiators passes through heat economisers on the hot water supply and is pumped back to the heat station.

Like all the offices we visited in New York and other great cities, and indeed like most offices in London, the great trouble is noise. It might be thought that by ascending high enough one would get above the noise zone as, so it is said, one gets above the fly zone. The flies were still in winter quarters when we made our visit, and we cannot say if it be true or not that they fail to accommodate themselves to their new environment; but certain it is that one could not escape from the babel of New York by climbing nearer to heaven. It may be that the noise is merely transmitted upwards through the air, or it may be that the steel framework of these buildings provides an easy route for it. The fact remains that there is far too much noise in these office buildings. The teachings of Professor Spooner have not yet had their effect either in America or Europe, and there still lies open before engineers and architects of both hemispheres a broad and profitable field for research. It may be of interest to mention in this connection that with a view to reducing noise and concussion when building near to blocks containing delicate apparatus—telephone exchanges, for example—the employment of welding in place of pneumatic riveting is being advocated.

A Steam Heat Station.

Everybody knows that in the greater American cities heat is delivered to offices and apartment houses from central heat stations. The Graybar Building, as we have seen, is supplied in that way. It may be of interest then to spend a few minutes in one of the latest of these heating stations. That selected is the Kip's Bay of the New York Steam Corporation, and has, beyond the fact that it is the *dernier cri* in stations of the kind, the additional attraction, to the American mind at least, that the Combustion Engineering Corporation erected for it a boiler plant, capable of generating 325,000 lb. of steam per hour, in eighty-four days, and twenty-three days later a second unit of the same size was lighted up. When finished, there will be twelve units of the same capacity, enabling, at a maximum, 3,900,000 lb. of steam to be generated per hour. It will then be the largest thing of the kind in the world. The guaranteed efficiency is high: 90 per cent. when generating 250,000 lb. of steam and 88 per cent. when generating 325,000 lb. The coal consumption will run into the enormous figure of 336 tons per twenty-four hours at full rate.

The boilers—of the Ladd type—are gigantic. From the bottom of the ash hopper to the top of the boiler drums is nearly 81ft., and to the summit of the air preheater connection nearly 127ft. It is impossible to show so vast a structure to an adequate scale, but the annexed drawing will give some idea, at least, of the arrangement, and those who are deeply interested may with the help of the lens pick out not a few details. The two photographic views reproduced on page 141 may help them to a further understanding of the construction. The great thing to notice is the advanced use of water walls. The furnace, fired from both sides, is tubed on all four and has, as well, the usual water screen; furthermore, water walls enclose the ends of the combustion chamber between the two banks of vertical generator tubes. Hence the whole boiler is practically enclosed by water walls. The burners are of the Lopulco type, and the coal is prepared in the manner usual where the bin system is employed. The economisers are of the tubular form and the air preheaters are of the plate type.

(To be continued.)

Reinforced Concrete for Sewer and Conduit Works.

No. I.

Pipes.

For some years past concrete, and more especially reinforced concrete, has played an important part in sewerage and waterworks. The following notes concern, in the main, conduits which serve to convey water by gravity and pipes of relatively small bore for pressure work. Pressure pipe work for the conveyance of large volumes of water is certainly now quite an accepted branch of reinforced concrete work, but it is of too specialised a nature to permit of its being discussed in the present articles. Broadly speaking, sewer and conduit work of the class outlined here falls into three categories:—(*a*) Concrete sewer pipes of a simple class which are now used to quite an appreciable extent as an alternative to stoneware or fire-clay pipe; (*b*) pipes of greater length and usually of smaller bore which are frequently cast by the centrifugal process and which have rather a wider application in waterworks than on sewerage works; and (*c*) large sewers and conduits constructed on the continuous system with the aid of forms, the latter being, as a rule, of a special class.

Sewer Pipes.

It is proposed to deal first with the more common class of sewer pipe which is particularly adaptable to the general run of sewerage work, though also quite useful for the conveyance of water under other conditions. A favourite form is that shown in Fig. 1, which depicts also the form of joint generally used. A length of about 3ft. is, as a rule, adopted, and the form of joint, which is very simple, is practically self-aligning and is finished off with cement. The circular form is usual, though oval pipes are sometimes used in order to obtain the advantages which

that section offers in the case of sewers. These concrete pipes are obtainable from makers who specialise in them, though on a large contract it may pay to put down plant for making them so as to save the cost of, and possible losses by breakage in, transit. The first essential is well-mixed concrete of fine quality, preferably with crushed granite for the aggregate, and the second is the ensuring of a dense wall by some suitable means of mechanical moulding. If pipes are made by an ordinary ramming process an indifferent product will nearly certainly result, the pipe wall tending to be very porous. Generally, the moulding system adopted by the makers follows the principle of the jar-rammer as used for consolidating moulds in the foundry; that is to say, a vibratory motion is given to the mould containing the concrete. The latter is acted on by gravity and

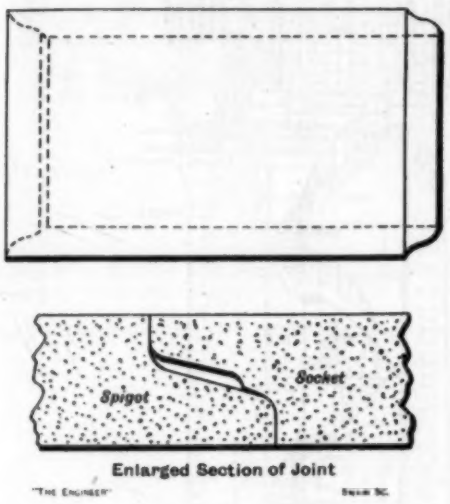


FIG. 1

the momentum of the moving mass, and the motion takes the place of the usual pressure or punning to compress the particles. Subjecting the concrete to vibration has the great advantage that air bubbles and superfluous moisture and impurities are brought, in the form of slime, to the surface, where they are readily removed. With it, too, a rapid solidification of the particles takes place before the initial set of the concrete occurs. The resultant pipe wall, if the process has been properly carried out, is homogeneous, of equal density throughout, and is entirely without air holes, cavities, stratification, or hair cracks. The interior surface, too, while not comparable for smoothness with that of centrifugally cast pipes, which may undergo a special polishing process, is quite reasonably smooth and certainly compares well with that of stoneware pipes.

Centrifugal Casting.

The tendency at the present day is to use centrifugally cast pipe, as the centrifugal action, properly

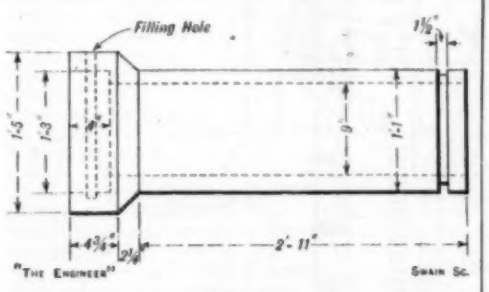


FIG. 2

applied, produces a very dense, smooth-bore pipe at relatively low cost. Moreover, when suitably reinforced, a centrifugally cast pipe will withstand considerable internal pressure if a 2–1 sand-cement mixture is used. For pipes which will not be subjected to heavy pressure, a 2–2–4 mixture of granite chips, sand and cement is suitable, and a small proportion of slaked lime is generally added to render the mixture more workable. If reinforcement is required, it is, as a rule, first machine-formed by the necessary wire being wound on an expanding steel drum and fed through a travelling eye geared to lay on automatically at any required pitch. The requisite diagonal, bracing and longitudinal wires are placed on by hand, then further layers of spiral reinforcement are laid on until the required weight of steel is made up. On the drum being collapsed, the cage can be removed endwise, and it is then placed in a light galvanised tube made in two or more sections keyed together. The tube forms the mould for the pipe, cast iron flanged runner wheels being bolted to the ends by means of outside longitudinal tie rods. The amount that the inner flange of the rings projects into the tube determines the thickness of the pipe wall, while the reinforcement is so wound as to leave a thickness of about ¼in. of concrete on the outer diameter. The actual spinning of the pipe may be briefly described as follows, though individual processes may differ from it in detail. The spinning machine upon which the moulds are placed comprises a bed frame on which is mounted a series of three or more parallel axles with cast iron discs at each end, the spacing of the axles being variable to suit different sizes of pipes. The end rings of the moulds rest on, and between, the revolving discs, which act as friction driving rollers, the first set of axle and disc only being direct driven. The machine is started up at a relatively low speed, and the concrete is introduced either by hand or mechanical means, as the case may be. The machine is then speeded up and run for from 5 to 10 minutes,

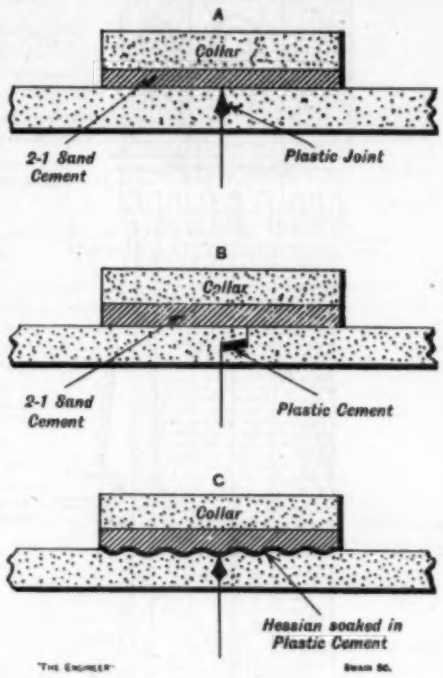


FIG. 3

when it is stopped so that the accumulated water may be expelled, after which the apparatus is again set in motion, but this time with an iron bar introduced into the pipe. This bar, while bearing on the concrete, is caused to move backwards and forwards, and it smooths out the concrete to the thickness determined by the flanges on the end of the mould, upon which it finally comes to bear. It also ensures a very smooth finish. At the completion of the operation the concrete has taken an initial set. The cage has freedom of movement within the mould, the centrifugal force which packs the concrete tending to centralise it.

A further and very important operation in the manufacture of concrete pipe is the curing. This is effected first by taking the pipes to a steaming chamber, where they are kept at about 130 deg. in wet steam for several hours, and then placed under water for anything up to twenty-eight days.

Joints.

It is quite feasible to make reinforced concrete pipes with spigot and socket joints if they are regarded as desirable. In Fig. 2 are shown suitable dimensions for 9in. pipe of this class, such as are used for general purposes on railway works in China. The pipes are of a simple, hand-moulded class, and are made with 1–2–4 concrete. The method of making the joint is made clear in the diagram. Generally speaking, centrifugally cast pipes, at all events, are more satisfactory if made in the form of a plain cylindrical barrel and collar joints used. These collars may be moulded in the same manner as the pipes by placing dividing rings with the necessary reinforcement cages between them at 6in. centres in the moulds. The inner surface, instead of being smooth, is roughened, and the pipe ends within them butt together. The actual joint used between the pipes, however, is a matter for choice. Three different types are shown in Fig. 3, that shown in view A being the most usual. The recess is filled with a plastic compound of a bituminous nature. In view B is shown a telescopic joint which is suitable for light pressures or drainage without the use of a collar; when used with a collar, as shown, it will stand fairly high pressures, and without the collar again it is suitable for the lining of boreholes. View C shows an arrangement which is claimed to permit of expansion and contraction.

Special Pipes.

With the exception of large diameter pressure pipes which are not, at the moment being discussed,

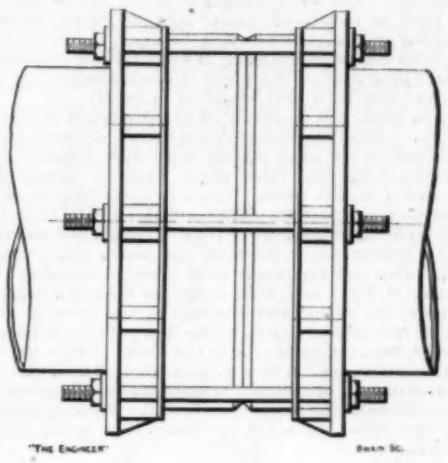


FIG. 4

as they call for special consideration, those produced by the methods already outlined meet the majority of practical requirements at the lowest possible cost. A special application, however, to which concrete pipe might be put is that of subaqueous pipe for, say, an outfall sewer. An interesting work of this class is at Sydney, where the crossing under the Middle Harbour was accomplished by a double syphon of reinforced concrete pipe. Each pipe is 6ft. in diameter and is built up of lengths of 100ft. The two pipes are laid side by side under the water, and are supported in the neighbourhood of each joint by concrete mattresses carried upon piles. Some details of the pipes are given in Figs. 4 and 5, from which it will be seen that collars 9in. thick and 6ft. long are moulded as an enlargement of the pipe at a distance of 12ft. from each end. It is this portion of the pipe which rests upon the supporting foundations. The joints between the pipes are of the spigot and socket class

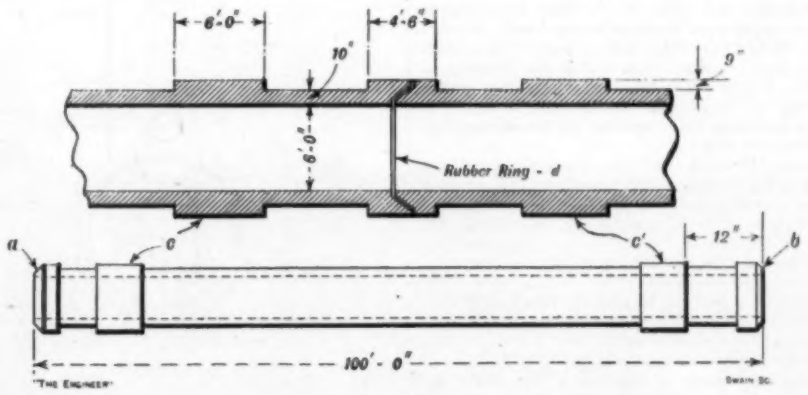


FIG. 5

as shown, but are arranged to permit of some latitude of alignment, while there is a groove for the insertion of a rubber ring. Against this rubber ring the pipes are drawn together by the collar and bolt arrangement shown. These collars are left in position under water and surrounded by mass concrete.

(To be continued.)

The Canadian Pacific Railway hotel, to be erected on the site of the present Queen's Hotel, Toronto, will be named the "Royal York." Plans have been approved, and the hotel, when completed, will contain more than 1000 rooms, being twenty-eight storeys in height. Work on the demolition of the present hotel will be started when the Canadian National Exhibition closes in September.

G

The Tâf Fechan Reservoir and Works.

No. II. (*Conclusion*).*

In our first article we described the reservoir generally and also referred to the overflow shaft which, we explained, discharges into the outlet tunnel, and is downstream from the valve tower. The latter is situated at the end of the cut-and-cover portion of the inlet tunnel and immediately over it, and is, therefore, within the reservoir. Access to the tower from the embankment is obtained by means of a light steel foot bridge, which passes directly over the centre of the overflow shaft, as seen in Fig. 5 in article No. 1. The valve tower, drawings of which are given in Fig. 6, is 12ft. in diameter internally and octagonal externally. The internal lining is formed of cast iron segments 5ft. deep, each ring being in four portions. The joints between the segments and rings are rust-cemented, and the filling behind the segments is fine concrete. The outer octagonal facing of the tower is built in rock-faced ashlar masonry, with chisel-drafted quoins, the hearting between the masonry and the iron segments being of 5 to 1 cement concrete. The upper part of the tower is machicolated and is surmounted by a spire sheathed in copper.

The water will be drawn off at three levels through 27½in. bends projecting through the masonry and guarded on the outer side by flap valves actuated by gearing from the valve tower floor by means of phosphor bronze ropes. The top water level in the reservoir is at 1082ft. O.D., and the centre lines of the three outlet pipes are at 1059ft., 1034ft. and 1009ft. O.D. respectively. Between the centre line of the top valve and top water level there is, therefore, a depth of 23ft., and 25ft. separates both the centre lines of the second and first valves, and those of the third and second valves. The flap valves discharge into a 30in. up-stand pipe in the tower, a 30in. sluice valve governing the flow in each case. These valves are actuated by geared headstocks from the next floor above in the tower in each case. There is access up and down the tower by means of a spiral steel staircase.

The arrangement of the piping at the bottom of the valve tower is shown in Fig. 7. The supply main, on leaving the up-stand pipe, is carried inside the outlet tunnel as a 39in. pipe as far as the upstream side of the overflow shaft, when it dips down beneath the tunnel, and from that point is taken to the outlet under the tunnel floor—as seen in Fig. 8. Just before reaching the outlet it is turned at right angles outward to the west, and is bifurcated into two 28in. branches, which are connected up to vertical strainers in duplicate, that have a truncated cone framework, surrounded by fine mesh, and are stiffened by heavier and larger mesh wire, all being enclosed within cast iron vessels, and the course of the water being upwards and outwards. Provision has been made for washing back the strainers by filtered water in the usual way.

It may here be explained that the compensation water which, it will be remembered, amounts to 6,835,000 gallons per day, is passed through Francis-type turbines, coupled to generators, supplied by James Gordon and Co., Ltd. The current from these generators is used to supply the necessary power for working various motors, and for the lighting of the filter house, tunnel, valve shaft, &c. The two turbine units at present installed are each of 75 brake horse-power, and each is capable of working under heads between 50ft. and 100ft. Provision has, however, been made for a third unit, so that, if, in future, the demand for high level—Upper Neuadd—water should exceed the capacity of the present trunk main, it would be possible to augment that capacity by an electrically-operated booster pump.

The water delivered from the reservoir is soft and of great purity, but, generally speaking, it is, as mentioned in our first article, peat stained. Hence it was decided to provide means for treatment and filtration to remove the stain, and for adding lime to neutralise the acidity. The contract for supplying the necessary plant awarded to the Paterson Engineering Company, Ltd., of Kingsway, London, W.C. 2, and it may be said at the outset that it has carried out the work exceedingly well.

The complete installation comprises :—

(*a*) Means for measuring the flow of raw water and adding sulphate or alumina, or other coagulant and lime automatically, in exact accordance with variations in inlet flow ;

(*b*) Rapid gravity filters for the clarification of the water ;

(*c*) All the necessary machinery and apparatus for cleaning the filter units and for operating the chemical feeders ;

(*d*) The housing for the complete plant, including a central administration building with its wash water tower, and the heating and lighting of the buildings.

The plant as installed is designed to filter 7,500,000 gallons per day, and it is contained in a building which, as may be seen from Fig. 9, is of a very neat design and has the somewhat unusual shape of the letter L, which shape was, we believe, called for by the configuration of the ground. Each wing of the L contains a battery of six filters, the construction of which will be described later. In passing, we may remark that the structure has, at first sight, more the appearance of a partially completed church than of such a utiltarian edifice as a water treatment house. It is proposed, when it is required, to add a further wing in which to house the plant necessary to treat an additional 4,500,000 gallons per day, so that the whole flow which it is intended to derive from the reservoir—amounting to 12,000,000 gallons—may be dealt with.

The raw water after passing through the strainers, of which mention was made above, is conveyed by means of a 20in. diameter pipe to the filters through a Kent Venturi meter. It is admitted to the filtration plant through a main inlet controller which is designed to maintain a constant level in the water trough, from which the filters are fed, no matter what the head on the inlet or the rate of draw-off may be. It is claimed by the Paterson Company that the special design of the patented controller which it provides for this purpose permits of a large float movement, and consequently of a powerful and accurate control with a very small movement of the valve itself.

The Venturi meter employed to measure the flow of water is of the recording integrating type, and the Venturi head is utilised to control automatically the supply of the coagulant and the lime exactly in accordance with the varying flows of the crude water. The methods of adding the two chemicals to the water are different. In the case of the alumina solution, the rate of addition is controlled by regulating the position of a tapered valve arranged in a constant-head tank, so that the discharge of the solution is always proportional to the rate of flow of the water, the regulation of the valve being effected by a cord from the mechanism of the meter. As a check on the accuracy of the apparatus, the alumina solution may be discharged from the valve into a graduated glass receptacle, fitted with a stop cock, so that the actual rate of flow through the valve can be definitely measured and checked by noting the time that it takes for a known quantity of liquid to pass into the vessel. The strength of the alumina solution is always maintained the same, and should the degree of stain or impurity change to an extent that necessitates an alteration in the rate of dosage, the altera-

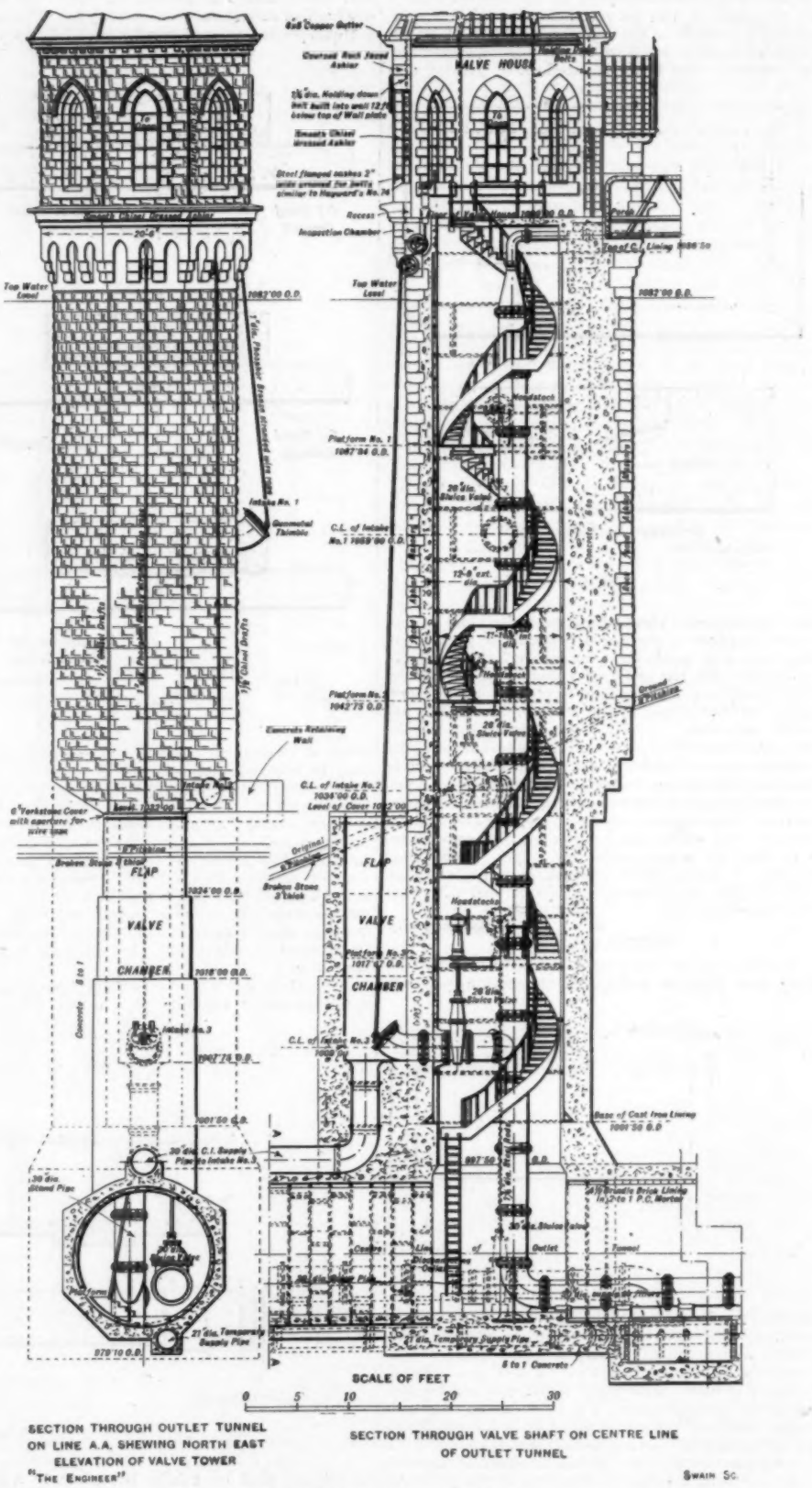

VALVE HOUSE
FLAP
VALVE
CHAMBER
Concrete Retaining Wall
Broken Stone 2 thick
Headstocks
Platform No. 1 1067·94 O.D.
Platform No. 2 1042·75 O.D.
Platform No. 3 1017·67 O.D.
Top Water Level 1082'00 O.D.
Base of Cast Iron Lining 1009·50 O.D.
SCALE OF FEET
0 5 10 20 30
SECTION THROUGH OUTLET TUNNEL ON LINE A.A. SHEWING NORTH EAST ELEVATION OF VALVE TOWER
SECTION THROUGH VALVE SHAFT ON CENTRE LINE OF OUTLET TUNNEL
"THE ENGINEER"
SWAIN Sc.

FIG. 6—DRAW-OFF VALVE TOWER

* No. I. appeared July 29th.

tion is effected by a hand adjustment of the head of solution over the tapered valve outlet.

With the lime mixture it is undesirable to use valves, and another method of proportioning the dose, so as to make it follow the variation of flow of the untreated water through the meter is adopted. A tipping bucket is operated by a known fraction of the water passing to the filters. At each throw of the bucket a measured quantity of the lime mixture is discharged into the water. The more often the bucket tips, the more solution is added, and there is an arrangement by which exactly the same quantity of mixture is added at each tipping. Hence, the quantity added is always proportional to the rate of flow.

The whole of the treatment machinery is housed in what is called the administration block, which is that part of the building where the two wings containing the filters meet. It has four floors—see page 146—and is surmounted by a dome, which, like the roof of the valve tower, is covered with copper sheeting. On the top floor of the tower there is a reinforced concrete tank having a capacity of 10,000 gallons, which contains the filtered water that is used for periodically cleansing the filters and for supplying the alumina and lime tanks. On the floor below there are two alumina solution tanks, and a lime mill which is driven by an electric motor. On the first floor there are two lime container tanks, the chemical cabinet, and the recording mechanism of the Venturi meter. On the ground floor is housed the following plant :—

(*a*) Two electrically-driven pumps for raising filtered water into the storage tank on the top floor.

(*b*) Duplicate electrically-driven air compressors which deliver compressed air to a receiver arranged outside the building, this compressed air, of course, being required for cleansing the filter units.

(*c*) The plant for warming the building by means of pipes and radiators.

There is also an electric lift for conveying the chemicals, &c., from a storage room, which is also on the ground floor, to the lime and alumina tanks on the second floor.

The coagulant tanks are in duplicate, and only one is in service at a time. Each is furnished with a wooden dissolving tray and with a stirring gear that is operated occasionally by hand to ensure uniform strength of the solution. In practice, the dissolving tray of one tank is charged with chemical overnight, the tank being then filled with water. Next morning the solution can be drawn from it for addition to the raw water. Meanwhile, the second tank is out of service, and, supposing it to require it, it can itself be charged with chemical and water so as to be ready to take its turn in the operations. Actually, so we understand, the size of the tanks has been so proportioned that each contains sufficient for a day's working. The tanks are provided with supports and sludging-out valves.

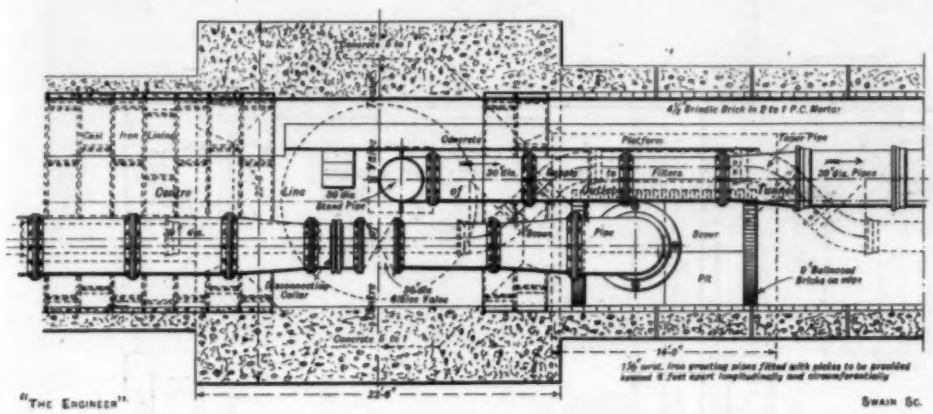


FIG. 7—ARRANGEMENT OF PIPING AT FOOT OF VALVE TOWER

The lime is fed into a slaking basket in a circular steel lime mill which is fitted with agitators and grinding rollers for crushing the lime particles and mixing them into a smooth homogeneous cream. The discharge from the mill is, as already explained, into either of two containers on the floor below. These containers are more or less semi-circular in shape, and each is capable of holding sufficient mixture for twelve hours' run at full load. In each the contents are kept continuously stirred by horizontal rotating paddles driven by small electric motors.

The raw water, after the addition of the chemicals, is passed to the filters, a battery of six of which is contained in each wing of the building. Each filter has a surface area of 24ft. by 14ft., or a total of 336 square feet, so that the twelve filters together represent a surface of 4032 square feet. To deal with 7,500,000 gallons in the twenty-four hours means that each square foot of surface must pass rather over 77 gallons each hour. Each filter unit is equipped with the Paterson Company's patented filter underdrain system of a design similar to that which we described in connection with the pre-filtration plant at the Walton works of the Metropolitan Water Board. We need not, therefore, refer to it in great detail on the present occasion. It may be said, however, that the filtered water collected by the underdrains is led to outlet chambers, which serve the double purpose of inspection boxes and automatic outlet control chambers.

The filters embody the Paterson system of air cleansing, the filtering medium being agitated by compressed air admitted to the bed by the underdrain system. After thorough agitation, wash water from the 10,000-gallon filtered water tank overhead is allowed to pass upwards and through the medium and to flush the impurities, loosened by the air scour, into concrete waste troughs, the size and position of which are, the Paterson Company points out, matters of great importance in the efficient and economic cleansing of the filters. The compressed air necessary for the cleansing is furnished by duplicate air compressors of the vertical reciprocating type. The air receiver, which is 7ft. in diameter and 30ft. long, is constructed of mild steel plate. The air is drawn off as required through pressure reducing valves. The controls for each filter are placed on the upper working platform, from which the attendant can observe the washing operation during the actual manipulation of the various valves.

The filtered effluent leaves the outlet chamber by means of a submerged orifice. Should the outflow from the filter tend to exceed the permissible maximum rate of filtration, the head of water above the submerged outlet orifice increases and lifts the float thereby throttling the outlet valve and reducing the quantity of water flowing into the outlet chamber. On the other hand, should the outflow from the filter be diminished, the level above the submerged orifice becomes lower and the float falls, and in doing so opens the outlet valve the slight amount necessary to permit of the passage of a flow of filtered water at the pre-

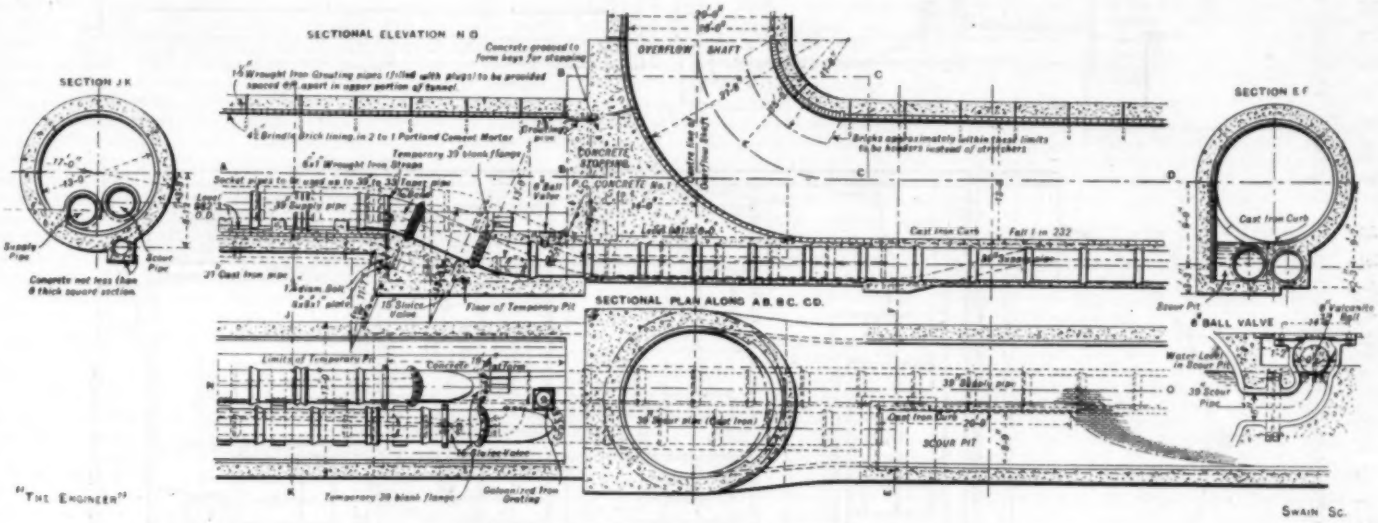


FIG. 8—ARRANGEMENTS AT FOOT OF OVERFLOW SHAFT

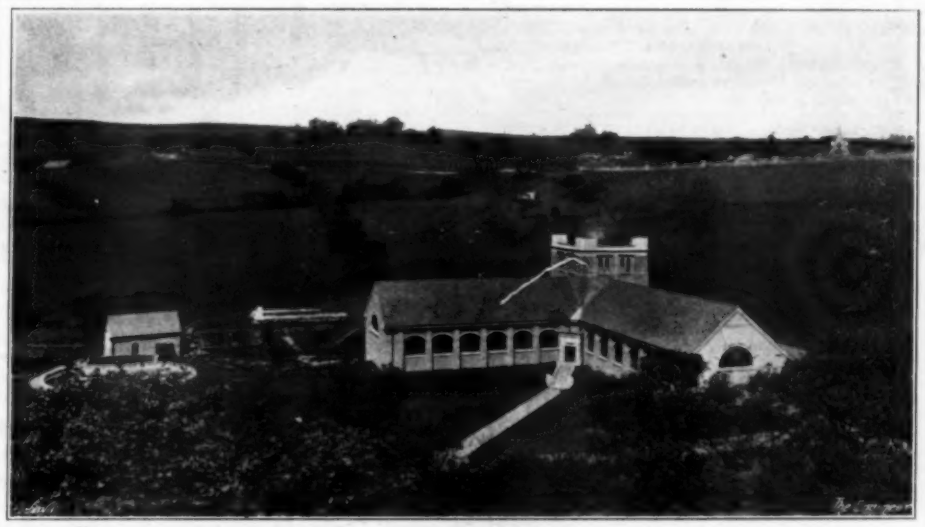
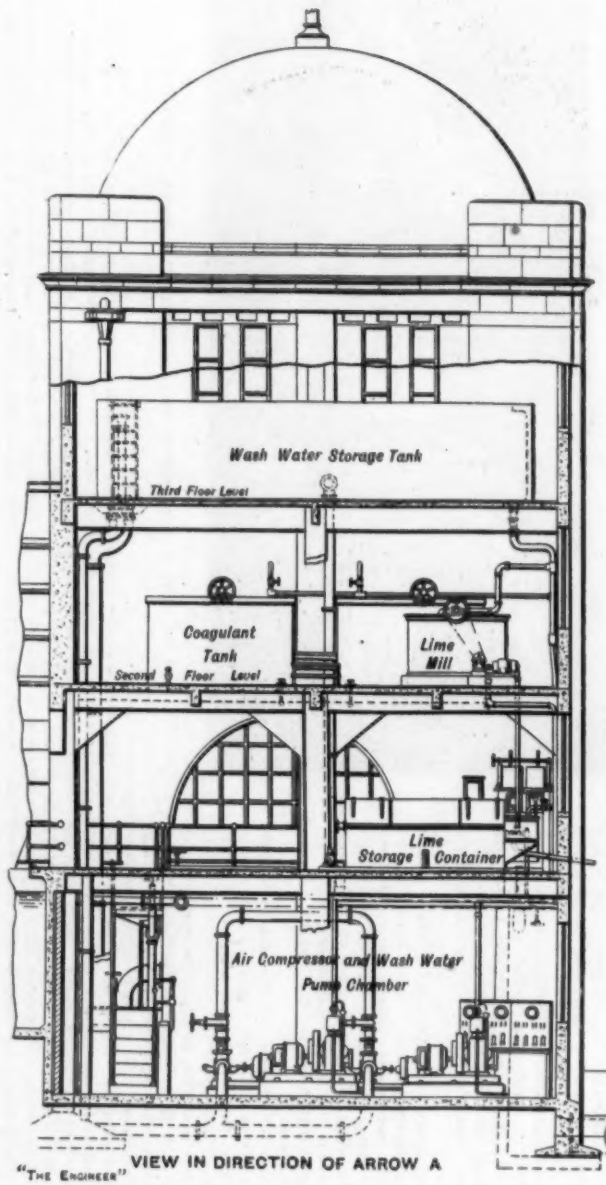


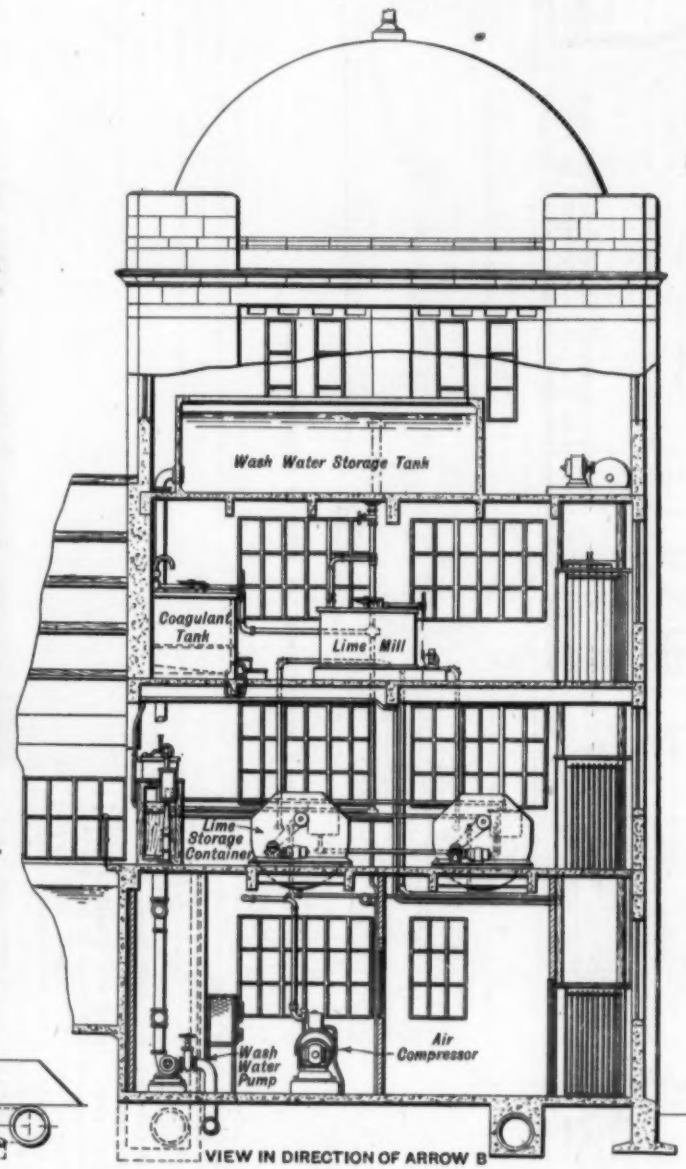
FIG. 9—TÂF FECHAN FILTER HOUSE AND CLEAR WATER TANK

TÂF FECHAN RESERVOIR—WATER TREATMENT HOUSE

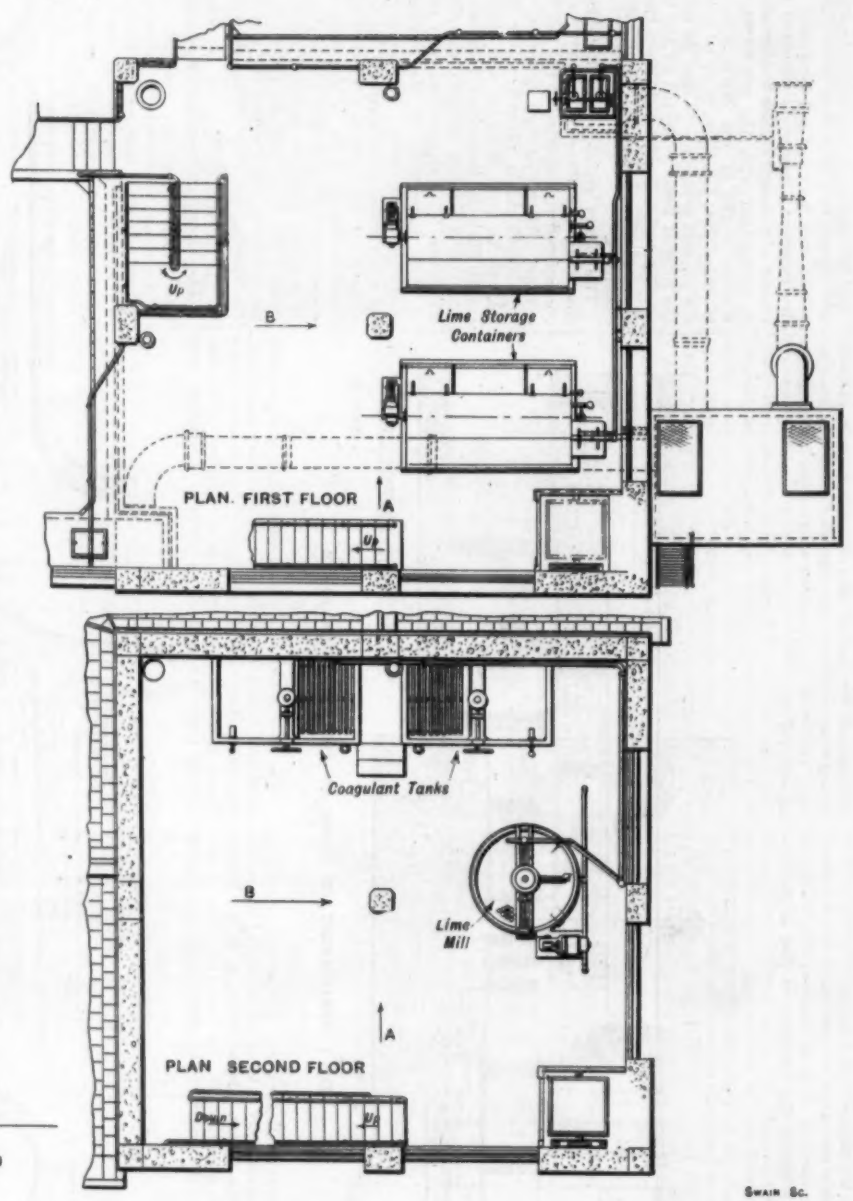
THE PATERSON ENGINEERING COMPANY, LTD., LONDON, ENGINEERS



"THE ENGINEER" VIEW IN DIRECTION OF ARROW A



VIEW IN DIRECTION OF ARROW B



SWAIN SC.

TÂF FECHAN WATERWORKS—WATER TREATMENT PLANT

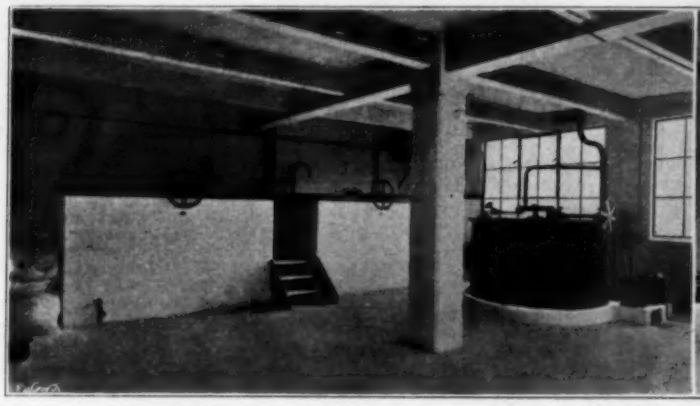


FIG. 10—COAGULANT TANKS AND LIME MILL

FIG. 11—LIME MIXTURE CONTAINERS

determined filtration speed. There is thus a critical level in the outlet box which enables a balancing effect to be obtained, whereby the filter discharge is kept sensibly constant, irrespective of the rate of inflow to the filter or the head of water above the filter bed. Various views in the filter-house are reproduced on page 150.

From the outlet control chambers the filtered water passes to pure water collecting channels and through them to the clear water tank valve well, or, if necessary, direct to the tank. The top of the tank is to be seen to the left of the engraving Fig. 9 with a small building beyond. The tank is 150ft. in diameter and 13ft. deep. It is constructed of 5 to 1 cement concrete and is lined with white-glazed brick, the excavations being embanked around the outside. The valve well is arranged alongside it, and it is provided with a regulating inlet valve and apparatus to maintain a constant head of water in the compensation basin. The outlet from the tank is controlled by a conical, balanced, self-closing valve. There are also an inlet hatch pipe and a by-pass valve arrangement, by means of which the clear water tank may be put out of action in case it becomes temporarily necessary to do so. The water passes from the clear water tank to a meter house through a Venturi tube of the water column type, there not being sufficient head for the usual mercury type.

The arrangement, not only of the treatment buildings but of the dam and the ancillary works, presents an excellent example of up-to-date practice in upland waterworks engineering.

The construction of the reservoir entailed, it may be added, the making of public road diversions, on the east and west sides of the valley, of a total length of nearly 3 miles, with all necessary culverts, bridges and other work, and also the provision of pipe sewers, septic tanks, and sewage outfall works. Moreover, the work done under the scheme included the demolition of eight farmsteads and some cottages, the removal of Capel Tâf Fechan and its vicarage, also a Congregational chapel, together with the removal of the bodies from the two attached graveyards, and their reinterment in a site south of the reservoir. Furthermore, about a mile of the 20in. trunk main from the Upper Neuadd reservoir, laid in the valley to convey the water to the Merthyr borough, had to be taken up and relaid at a higher level.

Under the Board's Act of 1924 the pipe line from the reservoir follows the Tâf Fechan Valley through Pontsarn, entering the Brecon-road at the south end of Cefn Bridge. It then crosses to the western side of the Taff Valley at the lower end of the Cyfarthfa Works, and continues through Nantygwenith-street to the Old Glamorganshire Canal. It is laid for a distance of about 9 miles alongside the Cardiff pipe line, in the bed of the canal—except where it diverges for the Cefn Glas Tank—to a point near Argyle-street, Abercynon. It is then taken through Argyle-street, and Glancynon-street, and again enters the canal for a short distance, leaving it near the new Roman Catholic Church. The route thence is through the swamp across the Great Western Railway and along Craig Evan Leyshon Common, and southwards through Mary-street, Cilfynydd and the Pontypridd area to the northern boundary of the Llantrisant and Llantwit Fardre Rural District Council.

Steel pipes lined with cement mortar, made by Thomas Piggott and Co., Ltd., mostly at Cardiff, under contract with the Board, were employed, and the valves were supplied by Glenfield and Kennedy, Ltd. The contract for pipe laying and other works on the pipe line was let by the Board to C. V. Buchan and Co., Ltd., of Brighton.

The pipe line and its branches consist of about :—(*a*) 2 miles of 36in. internal diameter pipes ; (*b*) 1 mile of 32in. internal diameter pipes ; (*c*) 9½ miles of 30in. internal diameter pipes ; (*d*) 7¼ miles of varying diameters from 23in. to 18in.; and (*e*) 1 mile of 7in. and 6in. cast iron pipes.

These variations are due to the number of different points at which bulk supplies are to be given, viz.:—(1) To the Merthyr Corporation—Penybryn Service Reservoir ; (2) to the Merthyr Corporation—Aberfan and Merthyr Vale ; (3) to the Merthyr Corporation—Treharris Service Reservoir ; (4) to the Rhymney Valley Board—Gelligaer, Trelewis and Caerphilly ; and (5) to Llantrisant and Llantwit Fardre Rural District Council.

Among other works there are the following :—(*a*) The pipe line crosses under the Tâf Fechan, about 200 yards south of Pontsticill Bridge, and below the point where the 20in. high-level main crosses, the new pipe line being laid under the 20in. in the public road. A 6in. branch connection has been taken off the main in the land acquired at Tylerybont, near this river crossing, for the purpose of boosting low-level water into the high-level main by means of electrically-driven pumps should the occasion for more high-level water arise. (*b*) The Taff is crossed at Cyfarthfa Works, where the main is supported by a steel truss. (*c*) The Taff and Bargoed Taf are crossed at Quakers' Yard—the cut waters of Pont Harvey having been raised to carry the main outside the bridge parapet. (*d*) The Taff is again crossed at Lewistown, Treforest. At this river crossing the old disused iron footbridge was replaced by a new steel lattice girder footbridge of 140ft. span, which, by arrangement with the Pontypridd Urban District Council, the public will be allowed to use. (*e*) The Great Western Railway is crossed twice. At Goitre Coed, Penlocks, the main is carried in a box girder, with a span of 62ft. at a height of 44ft. above the rails. The second crossing is near Travellers' Rest Halt, where the main passes under the railway.

When excavating for the pipe trench near Abercynon, an interesting find was made a few inches below the surface, of part of the old "tramroad" from Penydarren Ironworks, to the Old Canal basin, formerly the end of the Merthyr section of the Glamorganshire Canal. The cast iron tram plates, 3ft. long, were found in place, fixed to the original stone sleeper "blocks." It was over this tramroad that Trevethick ran his locomotive in 1805. The Board has presented a set of these rails and blocks to the National Museum of Wales, Cardiff, and also to the Merthyr Museum, Cyfarthfa Castle.

The Cefn Glas Tank break-pressure tank is situated near the summit of the hill on the western side of the Taff Valley, above Quakers' Yard, its top water level being 895·40 O.D. Its high altitude was determined for the purpose of supplying the Gelligaer district from the Tâf Fechan reservoir to as great a height as was feasible. It is 60ft. in diameter, with a depth of water of 10ft., and a capacity of 176,000 gallons. It is constructed of concrete, with a steel grid built into the floor and reinforcing bars in the wall. The roof is of reinforced concrete beams and slabs. For the purpose of saving water in the possible event of a burst taking place in the lower area, the two outlets are controlled by automatic valves. The six inlets are furnished with ball valves to prevent a shock to the main when the tank has become full. The Board has acquired and fenced off 1¼ acres of land upon which the tank has been constructed.

In conclusion, we desire to acknowledge our indebtedness to Messrs. Sir Alexander Binnie, Son and Deacon, and to Mr. Thos. F. Harvey, for the considerable assistance they have rendered to us during the preparation of this article.

The resident engineer for the reservoir and filtration plant, &c., was Mr. F. V. Stillingfleet, and for the pipe line Mr. J. F. J. Reynolds.

Conference on Fuel.

AN international Conference on Fuel is to be held from September 24th to October 6th, 1928, at the Imperial Institute, London. It is being organised by the British National Committee with the approval of the International Executive Council, World Power Conference. Lord Balfour has accepted the Honorary Presidentship, and Sir Alfred Mond the Presidentship of the Conference, and the chief participating industries—namely, coal, oil, gas and chemicals—are strongly represented on the Fuel Conference Committee and on the Technical Committee. The joint general secretaries are Messrs. Sholto S. Ogilvie and M. W. Burt, and the joint technical secretaries Messrs. E. W. Smith and E. J. Fottrell.

The following is an outline of the technical programme :—Classes : Class I., Solid Fuel ; Class II., Liquid Fuel ; Class III., Gaseous Fuel ; Class IV., Fuel Utilisation, General ; and Class V., General Aspects.

Divisions of programme :—Division 1, Composition and Classification of Fuels ; Division 2, Preparation of Fuels ; Division 3, Storage, Handling and Transmission of Fuels ; and Division 4, Utilisation of Fuels.

CLASS I.

SOLID FUEL : Coal (Anthracite, Bituminous, Lignite or Brown Coal) ; Peat ; Wood ; Shale ; Coke.

Division 1, *Composition and Classification of Solid Fuels.*—Section 1 (1) Composition and classification of solid fuels ; and Section 1 (2) Sampling and testing of solid fuels.

Division 2, *Preparation of Solid Fuels.*—Section 2 (1) Cleaning, drying, screening and grading of solid fuels ; Section 2 (2) Carbonisation of solid fuels (see also under gaseous fuel) ; Section 2 (3) By-product recovery ; Section 2 (4) Preparation of pulverised fuel ; and Section 2 (5) Briquetting.

Division 3, *Storage and Handling of Solid Fuels by the User.*

Division 4, *Utilisation of Solid Fuels.*—Section 4 (1) Utilisation of solid fuels for the generation of steam ; Section 4 (2) Utilisation of solid fuels in industrial furnace work ; Section 4 (3) Utilisation of solid fuels for domestic purposes ; and Section 4 (4) Utilisation of pulverised fuel.

CLASS II.

LIQUID FUEL : Oil (Mineral Oil, Tar and Oil produced from retortable material, Oil produced synthetically) ; Alcohol, &c.

Division 1, *Composition and Classification of Liquid Fuels.*—Section 1 (1) Composition and Classification of liquid fuels ; and Section 1 (2) Sampling and testing of liquid fuels.

Division 2, *Preparation of Liquid Fuels.*—Section 2 (1) Oil production from solid fuels (carbonisation, hydrogenation, &c.) ; Section 2 (2) Oil distillation ; Section 2 (3) Oil refining ; and Section 2 (4) Oil cracking.

Division 3, *Storage, Handling and Transmission of Liquid Fuels by the User.*—Section 3 (1) Storage and handling of liquid fuels by the user ; and Section 3 (2) Transmission of liquid fuels by the user.

Division 4, *Utilisation of Liquid Fuels.*—Section 4 (1) Utilisation of liquid fuels for the generation of steam ; Section 4 (2) Utilisation of liquid fuels in industrial furnace work ; Section 4 (3) Utilisation of liquid fuels for domestic purposes ; Section 4 (4) Utilisation of light oils (motor spirit) in internal combustion engines ; and Section 4 (5) utilisation of heavy oils in internal combustion engines.

CLASS III.

GASEOUS FUEL : Town Gas ; Producer Gas (from Solids, from Oils) ; Water Gas ; Blast-furnace Gas ; Natural Gas.

Division 1, *Composition and Classification of Gaseous Fuels.*—Section 1 (1) Composition and classification of gaseous fuels ; and Section 1 (2) Testing of gaseous fuels.

Division 2, *Preparation of Gaseous Fuels.*—Section 2 (1) Production of gas from solid fuels ; Section 2 (2) Production of gas from liquid fuels ; and Section 2 (3) By-product recovery.

Division 3, *Storage, Handling and Transmission of Gaseous Fuels.*—Section 3 (1) Transmission of gaseous fuels.

Division 4, *Utilisation of Gaseous Fuels.*—Section 4 (1) Utilisation of gaseous fuels for the generation of steam ; Section 4 (2) Utilisation of gaseous fuels in industrial furnace work ; Section 4 (3) Utilisation of gaseous fuels for domestic purposes ; and Section 4 (4) Utilisation of gaseous fuels in gas engines.

CLASS IV.

FUEL UTILISATION (GENERAL).

A. Utilisation of Electricity for—(*a*) Industrial heating, and (*b*) Domestic heating ; B. Waste heat recovery.

CLASS V.

GENERAL ASPECTS.—A. The training of fuel technicians ; B. A survey of the scope of organisations concerned with the efficient use of fuel in industry ; and C. The economic possibilities in the better co-ordination of fuel utilisation.

Audio Resonant Wireless Reception.

At a recent meeting of the Radio Society of Great Britain Mr. G. G. Blake described some investigations he has carried out in connection with the hot wire microphone. In a lecture delivered before the Royal Society of Arts in 1922,* Major W. S. Tucker demonstrated the extraordinary sensitiveness of a microphone of this type when included in one arm of a Wheatstone bridge, and placed at the orifice of a suitably constructed acoustic resonator, and he showed that by tuning the resonator the hot wire was only affected by one particular note. During the war this apparatus was successfully employed for locating the enemy's big guns, and it detected them without experiencing interference from near-by rifle fire and other noises, which so far as ordinary oral reception was concerned, entirely obliterated the sounds of the big guns.

This demonstration led Mr. Blake to look into the question of whether the hot wire microphone and resonator might be employed for audio-resonant radio reception. A scheme suggested by the author† is shown in Fig. 1, where M is the hot wire microphone included in one of the

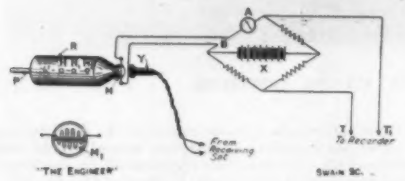


FIG. 1

arms B of a Wheatstone bridge, whilst a battery X keeps the microphone, which consists of a spirally wound filament of platinum wire, at red heat. The filament is placed in the orifice of a tubular resonator R, where any air movements into and out of the resonator are able to affect the resistance of the wire by their cooling action. Holes are drilled in the resonator, as shown at H, and the plunger P, which fits into the resonator, allows it to be tuned to a certain selected note. The leads T and T_1 are connected to a recording instrument, and as shown at A an ammeter is provided for indicating the current passing through the hot filament. The telephone receiver is connected to an amplifier of a multi-valve set, and if this set is making the signals of two or more interfering stations loudly audible, it should be possible to tune the resonator to the note of the station it is desired to receive and to reject the interfering stations.

Recently Dr. H. E. Watson, of the Indian Institute of Science, Bangalore, published a paper describing how he had put the suggestion to a practical test. The circuit employed is shown in Fig. 2, where R is a three-valve

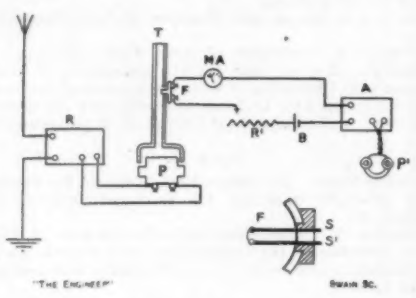


FIG. 2

receiver, A a Mark III. audio frequency amplifier, T a resonator with a hot wire microphone F at its centre instead of at its end, and consisting of a ·00024in. Wollaston wire run at a red heat. The effect upon the confused noises usually heard when receiving upon the longer wave lengths with an unselective receiver was found to be very remarkable, and led Mr. Blake to carry out experiments on his own account. With the aid of the arrangement shown in Fig. 3, signals from numerous C.W. and spark stations were received on an ordinary autodyne receiving set, consisting of a detector followed

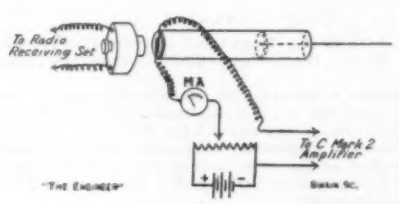


FIG. 3

by one or two stages of note magnification, according to the strength of the signals. Three resonators were tested, the smallest consisting of a tube ¼in. in diameter and 9in. long, and having a frequency of approximately 373 when its plunger was fully extended. The next resonator tested was 1in. in diameter and 21in. long, having a frequency of 160 when its plunger was fully extended; whilst the third resonator was 6in. in diameter and 15in. long, and had a frequency of 224.

All these resonators worked well, and it was found that the best scheme was to set the resonator to respond to a frequency of about 376, and to heterodyne the incoming signals to give a beat note of that frequency. For these early experiments a 0·00024 Wollaston wire was employed, and it was heated with a current of 4·5 M.A. supplied from a 6-volt accumulator, which maintained the filament at a dull red heat. Potentiometer and series-resistance control were alternately employed, with equally good results. The circuit was completed through the primary of the input transformer of a "C Mark II." amplifier and the signals were finally received on headphones.

The results were very encouraging, for even when several stations were working with considerable interference and when atmospherics were bad, only the selected station was heard. In order to put the selectivity of the hot wire microphone to a more stringent test, Mr. Blake devised an interference tester, as shown in Fig. 4, in which there are four separately controlled circuits, all of which obtain

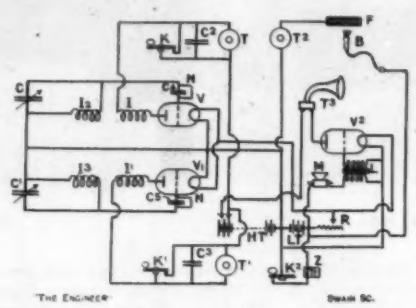


FIG. 4

their high-tension and low-tension supplies from a common source. Morse keys K and K_1 control two separately tuned oscillating valve circuits. Normally, these keys short-circuit the telephone earpieces, and notes are given in the "phones" when the keys are depressed. The frequency of the notes can be controlled in various ways, as, for example, by an adjustable grid leak and fixed condenser, or by the employment of a fixed grid leak and adjustable grid condenser. A variable condenser can also be used across the grid coil, and various other methods might be employed. The key K_2 controls a simple buzzer circuit, whilst the fourth circuit is employed to produce unpleasant noises, corresponding to atmospherics, these noises being produced in the "phones" T_3 by a steel file and metal brush. For demonstration purposes on the occasion of the lecture, this arrangement was substituted

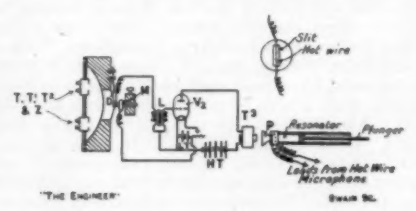


FIG. 5

by a simple telephone earpiece connected to a valve receiving set, working on an outside aerial. With the aid of this receiving set, which was designed by Mr. Maurice Child to work entirely off the supply main and without batteries, C.W. signals were picked up from Ongar and mingled with the artificially produced interference, and it was shown that with the aid of the hot wire microphone it was possible to rescue them again from the jumble of interfering sounds. The three "phones" and buzzer were all mounted on a base board forming the back of a cavity where all the sounds were collected or directed against a paper diaphragm to be seen at D in Fig. 5, to the centre of which the microphone M was attached. The microphone currents were amplified by a valve V_2, also to be seen in Fig. 5, the loud speaker T_3—devoid of its horn

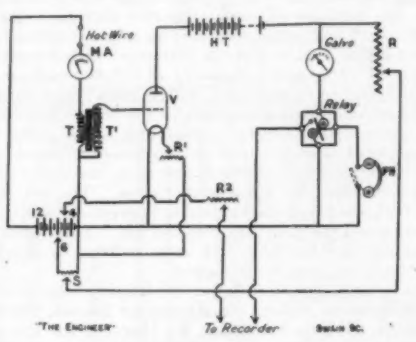


FIG. 6

—being placed in front of a resonator fitted with a hot wire microphone.

Numerous experiments have been made with different wave lengths, and numerous wires of different gauges have been tested. The best results have been obtained with a single wire ⅛in. long and 0·0001in. diameter. In order to obtain the maximum cooling effect from the pulses of air, a slit diaphragm was employed, as shown in Fig. 5. Moreover, in order to obtain really sharp tuning and to make the arrangement extremely selective, it is necessary, in addition to tuning the resonator accurately by means of its plunger, to the same frequency as the beat note of the signal, to adjust the distance between the loud speaker T_3 and the resonator, according to the strength of the received signal. Even when receiving powerful signals, the variations in the current in the hot wire circuit were found to be less than 1 M.A. With a steady filament current of 16·5 M.A., the current rose during the reception of a signal to 17·4 M.A., but it would not be difficult to devise means of recording these small current changes.

In order to make things more certain a stage of amplification was added, and a "zero shunt" circuit was employed for the purpose of balancing out the steady plate current by an opposing E.M.F., which, in accordance with Mr. Blake's method, is obtained from the filament heating battery by means of a potentiometer. The arrangement is shown in Fig. 6, where a single 12-volt battery supplies current for all the circuits with the exception of the plate circuit. The full pressure of 12 volts is applied through the circuit composed of the primary T of a transformer, wound for a resistance of 200 ohms, a milliammeter and the Wollaston wire filament of the hot wire microphone. A potentiometer across half of the accumulator supplies the opposing E.M.F. for the zero shunt, whilst a 2-volt tapping from the same accumulator provides the current for the secondary circuit of a relay. The secondary of the transformer T_1 is wound for a resistance of 9600 ohms. The plate circuit of the valve includes a 75-volt battery, a delicate galvanometer, and the primary winding of the relay. The resistance R included in the zero shunt circuit is adjustable between the values of 100 and 600 ohms.

During the lecture the selectivity of this method of audio-resonant selection was put to a somewhat severe test. Signals were received on the outside aerial and then badly jammed by three assistants operating the Morse keys of the interference tester, shown in Fig. 4, and it was shown that individual signals could be picked out of the mixture of noises. To make the recorded signals visible to the audience, the recorder movement was magnified and thrown upon the screen.

* See The Engineer, December 8th, 1922.

† Lecture to Radio Society of Great Britain, "Some Suggested Lines for Experimental Research."—*Wireless World*, vol. XIV., June 25th, 1924.

THE INSTITUTE OF METALS.

As previously announced, the autumn meeting of the Institute of Metals will be held at Derby from September 6th to 9th, under the direction of Sir Henry Fowler, K.B.E., vice-president, and with the assistance of Mr. G. W. Woolliscroft, M.I. Mech. E., who has undertaken to act as the honorary local secretary of the meeting.

The following programme has been arranged. On Tuesday, September 6th, at 8 p.m., the sixth autumn lecture will be delivered in the Municipal Technical College by Dr. L. Aitchison, F.I.C., the title being "Non-ferrous Metals in Modern Transport." On the Wednesday morning, at 10 a.m., there will be a general meeting of members in the Municipal Technical College, at which, after the transaction of some business, a selection of papers will be presented in abstract and discussed. In the afternoon there will be alternative visits to the carriage and wagon or locomotive works of the London, Midland and Scottish Railway Company, or to the Derby Crown China Works. At 8 p.m. there will be a reception by the Mayor of Derby (Councillor A. H. Domleo) in the Art Gallery.

On the Thursday, at 10 a.m., the general meeting of members will be continued in the Municipal Technical College, when a further selection of papers will be presented in abstract and discussed as time permits. In the afternoon there will be the following alternative visits:—Rolls-Royce, Ltd., or Leys Malleable Castings, Ltd., or W. Bemrose and Sons, Ltd. (printing works). In the evening, from 7 p.m. to 9 p.m., there will be a smoking concert in the Assembly Rooms, which will be followed by a dance. On the Friday there is to be an all-day excursion by motor chars-à-bancs to the Peak District.

The following papers are expected to be submitted:—(*a*) W. T. Cook and W. R. D. Jones, "The Copper-magnesium Alloys, Part II.;" (*b*) W. Hume-Rothery, "Researches on Intermetallic Compounds: VI., The Reaction Between Solid Magnesium and Liquid Tin;" (*c*) K. L. Meissner, "Age Hardening Tests with Elektron Alloys;" (*d*) A. R. Raper, "The Equilibrium Diagram of Copper-tin Alloys Containing from 10 to 25 Per Cent. of Tin;" (*e*) Cyril S. Smith, "Note on Cathodic Disintegration as a Method of Etching Specimens for Metallography;" (*f*) H. Sutton and A. J. Sidery, "The Protection of Aluminium and its Alloys Against Corrosion;" (*g*) H. Sutton and J. W. W. Willstrop, "The Nature of the Film Produced by Anodic Oxidation of Aluminium;" (*h*) C. J. Smithells, W. R. Pitkin and J. W. Avery, "Grain Growth in Compressed Metal Powder;" (*i*) Marie L. V. Gayler, "The Undercooling of Some Aluminium Alloys;" (*j*) A. G. C. Gwyer and H. W. L. Phillips, "The Constitution of Alloys of Aluminium with Silicon and Iron;" (*k*) F. Hargreaves, "Effect of Work and Annealing on the Lead-tin Eutectic;" (*l*) W. Hume-Rothery and S. W. Rowell, "The System Magnesium-cadmium;" and (*m*) C. H. M. Jenkins, "The Constitution and Physical Properties of Some of the Alloys of Copper, Zinc and Cadmium."

Though none of the known deposits of chrome ore in the Transvaal seem equal in grade to the 45 to 48 per cent. of the Rhodesian deposits, Transvaal deposits have, according to the *S.A. Mining and Engineering Journal*, great profitable possibilities, dependent upon transport facilities. Thus, though in the Lydenburg district chrome is being exported at a small profit from workings near the railway, the larger and more important deposits of that district are situated a distance of 16 miles from railhead, with bad roads intervening. The Government will not construct the short line necessary to work those deposits unless the mining interests concerned are prepared to supply the necessary capital. Chrome deposits in the Rustenburg district are fortunately situated on the railway, and an export trade with the Continent of Europe is being built up. It is noteworthy that Sir Edmund Davis, who controls the Rhodesia Chrome Trust, stated recently that unless new discoveries of chrome were made elsewhere, the whole of the supplies of chrome would come from Southern Rhodesia. With a little more encouragement in a practical form from the railways, the Transvaal chrome industry might prove a competitor of the Rhodesian Chrome Trust.

Railway Matters.

THE Assam-Bengal Railway programme of extensions just published covers over 238 miles of metre-gauge line. Out of the capital expenditure of nearly 100 lakhs budgeted for in the current year about 70 lakhs has been allotted for new lines which are either actually under construction or in contemplation.

THE first lines of way between Retiro Station, Buenos Aires, and Maldonado Junction, a distance of nearly three miles, have been made available for fast and slow traffic instead of two being used only by fast trains and two by slow. Electric traction is employed on all lines, and automatic signals have now been provided. The rails are of 85 lb. and 100 lb. sections instead of 56 lb., and are laid on transverse sleepers.

IN *The Times* of July 23rd there was a letter from a correspondent living at Alexandra Park, complimenting the London and North-Eastern Railway on the consistent punctuality of its up expresses and naming in particular the West Riding Pullman, which is timed to run non-stop from Wakefield to London at the average speed of 56 m.p.h. Of greater note is the comment made that he has often been impressed by the remarkable regularity of the express goods trains.

THE number of persons killed and injured by trains running into obstructions at level crossings is now shown in the annual returns of railway accidents, together with the number of such accidents, separately, instead of under the common heading of "Trains running through gates or into other obstructions." The recently published returns for the year 1926 show that there were 141 such cases, as against 135 in 1926, and 18 "other persons" were killed and 37 injured, as compared with 19 killed and 35 injured in 1925.

THE recent Bank Holiday traffic was carried without any serious railway accident. Two locomotive failures were reported, but there were no personal injuries—only delays. Early in the week a passenger train engine on the Tilbury section of the London, Midland and Scottish lost an engine tire and on Monday the connecting-rod of an engine drawing a passenger train broke near Christchurch, on the Southern Railway. Two engines and six coaches of an excursion train were derailed near Whitby on Sunday night.

A SUGGESTION was made by a correspondent lately in *The Times* that, as fourteen years and not twelve is now the school leaving age for children, half fares should be extended accordingly. We may observe that the age of twelve was fixed by the cheap trains clauses of the Regulation of Railways Act, 1844, on the ground, presumably, that children weighed less and occupied less space than adults. To-day their weight is about the same as in 1844, but in every other respect they expect—and receive—the same consideration as their elders.

A MONTH ago it was rumoured that Sir Guy Granet was about to retire from the chairmanship of the London, Midland and Scottish Railway and was to be succeeded in that position by Sir Josiah Stamp, the president of the executive. Subsequently it was announced in the Press that inquiries made at Euston led to the answer that the authorities there knew nothing about it. It appears, however, that the rumour was true. On Thursday of last week an official intimation was issued that Sir Guy, owing to other calls on his time, desires to retire in October. Sir Josiah has, therefore, been made a director and elected chairman, but will continue to act as president of the executive.

WHEN Lord Aberconway was addressing the proprietors of John Brown and Co., Ltd., a short while ago, he criticised the railway companies as regards the rates for the carriage of coal. "The companies," he said, "were carrying hardly any coal at all now. They had far better carry coal at a small profit than carry none at all. They had their overhead charges to meet like other people. He hoped they would be able to arrive at some equilibrium which should be calculated on different factors, among the most important of which was the question of foreign competition." The main point of interest in the above remarks of Lord Aberconway is that he happens to be the chairman of the Metropolitan Railway.

NINE days prior to the fatal collision at Hull on February 14th, *i.e.*, on the 5th idem, there had been a less serious accident there which was brought about by an excursion from Halifax overrunning its signals and colliding with a train arriving from Hornsea. The driver of the special did not know the road between Goole and Hull, so he was provided with a pilotman. The signals for the two arrival roads in question are quite distinct, but when the pilotman saw those for the Hornsea train in the "off" position he jumped to the conclusion that they were for his train and overlooked his own signals, which were at "danger." Lieut.-Colonel Hall inquired into the accident, and in his recently issued report he observed that he has no comment to make except to remark that it was another example of the class of accident preventable by automatic train control.

THE application to the Railway and Canal Commission of the Tilmanstone (Kent) Collieries, Ltd., for permission to construct an aerial ropeway to convey coal from the collieries to Dover was, as related in this column on March 25th last, rejected. That was done, because, as the President of the Court said at the rehearing on July 27th, "The scheme was incomplete in its inception and based upon inaccurate and illusory plans." The proposed ropeway was, added Mr. Justice Sankey, in the national interests, but the Court would not have been doing its duty had it sanctioned the scheme as submitted. Permission was given at the end of May to submit amended plans and that, as we have said, was done last Wednesday week. It was stated that prior to the coal stoppage the output was 1000 tons a day; that that quantity could be doubled in three months were the ropeway sanctioned; and that it would gradually be increased to 4000 tons a day. The cost would be £93,000. His lordship said he must guard against granting a monopoly and so the Order would provide for liberty to apply to the Court. The scheme would be approved.

Notes and Memoranda.

IT is claimed that the Newcastle-upon-Tyne Electric Supply Company is the largest of its kind in Europe. Its business shows a regular growth of about 11½ per cent. per annum.

BETWEEN 1919 and 1925 the mechanical power used in American industry increased 30 per cent. per worker employed, and the value of production per wage earner rose from 2751 to 3193 dollars.

A RECENT official report concerns the collapse of two furnaces of a boiler on board a small steamer, and in his observations the Engineer Surveyor-in-Chief gives the following advice:—Several explosions under similar circumstances have occurred recently, and it is again necessary to call the attention of those responsible for the running of boiler installations to the advisability of thoroughly and frequently testing water gauge mountings by the double "shut off" method, where such arrangements are fitted.

AN article in the *Engineering News-Record* describes the collapse of an iron truss bridge at Danville, Va., through the wood flooring catching fire. The wreckage of four 136ft. spans fell into the river below, and an examination of the structural members indicates that failure of the truss in each case was brought about by the softening and buckling of a compression member at or about the floor level. In most cases the first failure seems to have occurred in an intermediate post—two 8in. channels laced—but in one span probably in a batter post. No elongated or necked eyebars appear, and there is not a broken eyebar in sight. The collapse of each span was gradual, the trusses careening toward the side first giving way. Many of the top chord members came through practically intact, most of the joints at panel points opening by shearing of the rivets or by actual breaking of the top flange splice plates.

ONE of the member firms of the Federation of British Industries is placing upon the market a trench digger which attracted a good deal of attention at the Yorkshire Agricultural Show at Darlington. The machine is intended for excavating trenches and ditches in ordinary ground, and should be particularly useful for land drainage work. The standard machine will cut a trench 9in. wide down to a maximum depth of 30in., but other sizes can be arranged for. The earth can be discharged along the side of the trench being cut for open drains, or can be shot back into the trench after mechanically placing pipes in position as the trench digger travels along. Another use for which the makers consider the machine is well adapted is cutting the necessary trenches and laying underground cables. It is claimed that its employment enables trenching work to be done at about one-eighth of the ordinary cost of manual labour.

IN commenting on the explosion of a cast iron steaming box in a Manchester textile factory, the Engineer Surveyor-in-Chief, Board of Trade, makes the following remarks:—The joint of this door was made by means of a narrow spigot pressing on a piece of packing inserted in a groove, the tightening pressure being put on by means of bolts placed outside the jointing circle. This method imposes considerable stress on the cover. The failure of the door is attributed to the manner in which a defect in the joint had been temporarily made good. The arrangement caused a local thickening of the joint, so that when the nuts on the securing bolts were hardened up severe stresses were set up in the cover itself, ultimately bringing about fracture. It is advisable in such cases where the doors are very frequently opened and then tightened up again, and the joints used are fitted by unskilled operatives, that the doors should be of very heavy scantlings and the joints of good design, so as to reduce the risk of damage and accident to a minimum.

THE principal use for nickel steel to-day is probably in the automobile industry, but it is fairly widely used in general engineering. Electro-plating with nickel is an important outlet for the metal, while nickel-silver—formerly known as German silver—is perhaps next in importance, and is growing rapidly. Monel metal, which is becoming increasingly popular, is a natural alloy of copper and nickel, as they occur in the ore, the proportions being about 67 per cent. of nickel, 28 per cent. of copper, the remaining 5 per cent. comprising iron, manganese, silicon, carbon, and other minor elements. Monel metal was developed by the International Company, but the Mond Company markets a somewhat similar alloy made by the combining of the two metals. A new alloy, known as "Permalloy," contains about 80 per cent. of nickel and 20 per cent. of iron, and possesses extraordinary magnetic permeability. An increasing amount of nickel is being sold for the manufacture of pure nickel castings and sheets from which various finished articles are produced. A small amount finds its way into the chemical industry for use as a catalytic agent.

IN a short note in *Nature* of July 9th, dealing with some recent work in hydrodynamics, the opinion was expressed that during recent years the centre of gravity of pure hydrodynamical research appeared to have shifted to the Continent. The writer had in mind the new orientation given to this subject by the Prandtl theory and its various developments on the theoretical side, and the extraordinarily high degree of experimental skill exhibited in the production of the kinematographic films of fluid motion shown at Professor Prandtl's recent lecture before the Royal Aeronautical Society. More mature consideration, says our contemporary, however, suggests that the opinion so expressed was too sweeping, in that it did less than justice to the large body of British scientific workers who have contributed to this and other branches of hydrodynamical investigation. A wrong impression certainly tends to be created by the tardiness with which completed papers reach publication. Reports and Memoranda of the Aeronautical Research Committee, for example, are not usually available until anything from six to sixteen months after completion of the research. The result is that independent research workers not in direct touch with the *personnel* at Government research stations may remain for a considerable period in complete ignorance of important developments occurring in their own field.

Miscellanea.

A SUPPLY of water is to be provided in Healesville, Victoria, at a cost of £17,740.

IT has been decided to construct an aerial ropeway from Tilmanstone Colliery to Dover Harbour. The distance is about 7 miles.

IT has been decided to proceed at once with the construction of a hydro-electric power plant at Kolonnawa, Ceylon. The first unit is to be of 3000 kilowatts.

IT is proposed to make a trial shipment of about 5,000,000ft. of timber from the forests of Victoria, Australia, to England, with the object of testing the possibility of developing the industry.

MUCH attention is being attracted in South Africa by the reports of activities on the corundum claims in the Rusape district. It is reported that an extensive deposit has been traced from Inyazura to Marandellas.

THE Sydney City Council will shortly require £1,000,000 for the reconstruction of the streets of the city with concrete and bitumen in the main thoroughfares and concrete in the less important streets. Wood blocking will be done away with.

IN an article in the New York *World* of August 3rd it was stated that after many years experimenting the Remington Arms Company has discovered a method of making ammunition which will prevent rust, corrosion and pitting, and will practically eliminate erosion in gun barrels.

ACCORDING to the *Financial Times*, negotiations are on foot which seem likely to lead to the formation of a great brass trust. They are being conducted on behalf of the Mansfield and Stolberg groups, the former of which produces some 24,000 tons of copper annually, and the latter some 18,000 tons of zinc.

A TECHNICAL college has been instituted at Hangchow, Chekiang, China. It is divided into several departments including electrical, mechanical, practical chemistry, and dyeing and weaving. While the students and apprentices are taught all general courses, each class is required to do practical work in the workshops for over 1000 hours a year.

NEGOTIATIONS between the Victorian Electricity Commission and Flinders Shire Council for the acquisition by the Commission of the Sorrento electric light undertaking have, according to the *Industrial Australian*, now been completed, and the work of extending the Commission's mains from Dromana to Portsea are to be started shortly. It is anticipated that the current will be available before next Christmas.

IN 1926 a total of 1,309,782 tons of nickel ore was smelted at Sudbury, Ontario, producing 78,643 tons of matte containing 39,038 tons of nickel and 24,159 tons of copper. During the same year 34,908 tons of matte were exported and 33,489 tons were refined at Port Colborne. Precious metals recovered during the refining of Canadian nickel-copper mattes at Port Colborne, Ontario, and at Clydach, Wales, had in 1926 a total value of well over 1,500,000 dollars.

THE Wagga Municipal Council has been advised by the New South Wales Public Works Department that there is no likelihood of the Burrinjuck electricity scheme being available this year. The Department admitted that various towns had been led to believe the scheme would be completed long before this, but the erection of buildings at the power station at Burrinjuck dam to house machinery were not yet completed. Even when finished several months will be required to complete the installation of the machinery.

THE Panamán Government proposes to convert Panamá into a free port of entry. The plans, now being considered, call for the construction of a sea wall at an estimated cost of 1,500,000 dollars (£300,000). The work is to include the erection of a number of wharves; dredging of the existing channel; filling in swamps; and laying out a large residential area. These undertakings are estimated to cost 5,500,000 dollars (£1,100,000). Few engineering difficulties exist in connection with any part of the proposed construction. The harbour, which is good, is enclosed at the south by several rugged islands, the largest of which are Perico and Flamenco—both belonging to the United States—and Taboga. The erection of a number of new concrete and brick buildings is also contemplated. The main streets of the city, which run north and south, are cut by the Avenida Central. The approaches, however, are encumbered by narrow and crooked streets, and these it is proposed to straighten out and extend. New sanitation works for the city have already been authorised, and work thereon, including the construction of flood-water drainage, has been commenced.

IN connection with the improvement works decided upon by the Santos Dock Company, contracts have been entered into for the construction on the Island of Barnabe of four large petrol tanks, three with a capacity of 3000 tons and one of 9000 tons, connected with the quays by three pipe lines, permitting of the discharge simultaneously of two tank steamers of the latest type. Four additional tanks will be constructed for gas oil, and later on tanks for Diesel oil. The formation of the ground will allow the tanks to be placed behind a range of hills, thus affording complete protection to property on the mainland in case of fire. It is intended, later, to remove to Isla Bernabe the combustible oil tanks now in use at Vallongo. For the storage of petrol and paraffin arriving in boxes and drums, two specially designed warehouses, measuring 75 m. by 20 m., are to be constructed on the quays of the same island. Another warehouse of the same size will be built for storing corrosives and other inflammables. The explosives will be kept isolated in cells specially designed to prevent explosion by contact. Preliminary work on these constructions is well advanced; the bases for the tanks are being prepared, and the earthwork between the quays and the shore has also been commenced. At the port of Santos, construction is proceeding with an additional stretch of 300 m. of quays with a minimum depth of 10 m. at low water, so as to allow of the simultaneous berthing of two large type tank steamers.

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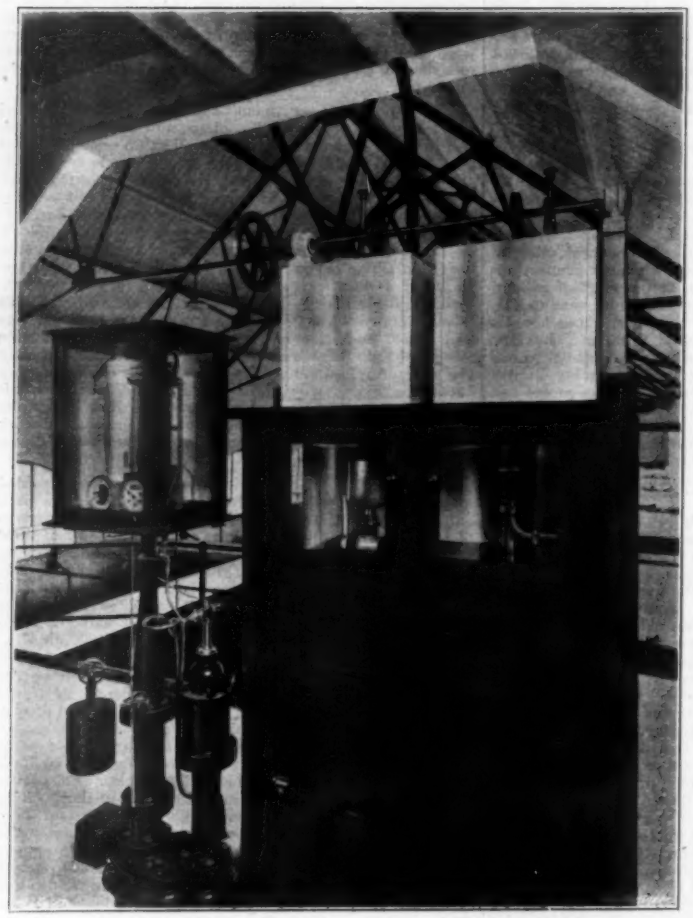

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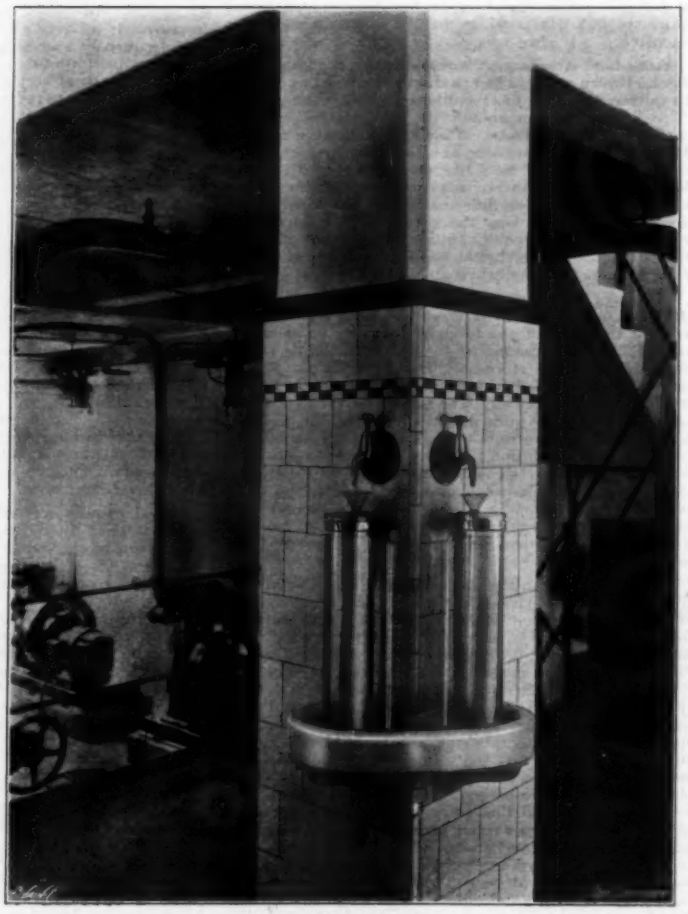

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THE ENGINEER.

AUGUST 5, 1927.

Overhead Transmission Lines.

SOME day the people of this country may enjoy the advantages of a cheap and abundant electricity supply, or, at any rate, sooner or later electricity may be placed at the disposal of most people who care to use it. The success of the Government's "gridiron" will not depend solely upon the thermal efficiency of super-power stations or the benefits that are expected to accrue from interconnecting them, but upon the price of a Board of Trade unit. That something more than efficient generation is needed has become clear to all electrical engineers, who are endeavouring to discover the best means of delivering efficiently generated current to consumers. Cheap distribution is now regarded as just as important as cheap generation, which in the past seemed to be looked upon as the only thing that really mattered. In certain countries, where the consumption of electricity per head of population is considerably higher than it is in Great Britain, extensive use has been made of overhead lines for transmission and distribution. High transmission pressures have in some cases left no alternative, but even for distribution at the ordinary voltages overhead lines have been employed because they are cheap. What could be more natural, therefore, with a cheap and abundant supply long overdue, than the adoption of overhead lines in Great Britain; what could be more advantageous or desirable? Experience gained on the Continent and elsewhere has indicated clearly that if electricity is to be delivered to farms and thinly populated areas the overhead system must be employed. But although this method of transmitting and distributing current is beginning to come into vogue in certain parts of England, Scotland and Wales, engineers appear to be getting a little uneasy about the cost. Whereas on the Continent and elsewhere the overhead system has proved economical, certain British engineers are declaring that, here, it is no cheaper than cables. In the year 1923 the Institution of Electrical Engineers appointed a committee to investigate and report upon electricity in agriculture. From various sources that committee collected a large amount of information, which enabled certain definite conclusions to be drawn. One of the conclusions was that overhead lines which cost about £100 per mile in Sweden might possibly be erected in this country at a cost of from £250 to £500 per mile. That surely was bad enough, but, according to an article appearing in a recent issue of the *Electrical Times*, three-phase low-pressure lines for developing a demand and for exploring rural and other areas are costing anything from £500 to £800 per mile. This difference in the cost of British and foreign overhead lines is not attributable to excessive cost of British labour or material; it arises mainly from regulations sanctioned by the Government—the Government that has promised to provide the cheap and abundant supply.

Of the various interfering bodies that hamper the work of the electric power engineer, the Post Office appears to be one of the most troublesome. In many cases, states the writer of the article, the Post Office has two lines of telegraph or telephone poles and one or more underground cable culverts running along the same country road, all of which are there for the convenience of people living in distant places and seldom for those who reside near the road which the lines traverse, yet when an electric lighting supply is to be given to these country districts it is often found impossible to do so except at unwarrantable expense because the Post Office may either refuse to transfer its lines or make an extortionate charge for doing so. Insulated cables have in consequence to be used on the poles for the power supply, thus increasing the cost of the distribution equipment. At one place, where the Post Office had poles on both sides of the road and a cable under the road, the cost of distribution lines for electric lighting was increased by 60 per cent., a figure which might easily reach 100 per cent. in other places. If the supply people try to escape the Post Office regulations by placing their poles on land on the private side of the road hedge they are frequently confronted with outrageous demands from farmers, who claim that the land is extremely valuable. When the Post Office erects a new line where an electric light distribution line already exists it is able to charge half the cost of any protective arrangements that may be necessary, to the electricity supply people. When supply undertakings desire to run high-pressure lines across Post Office wires the cost of guarding or of partly placing the lines underground is very serious. If the Post Office is persuaded to put its lines underground, at the expense of the supply undertaking, it is alleged to choose the most costly method. Many other obstacles to cheap overhead distribution are discussed by this opponent of the existing regulations, who describes the practice of splitting the neutral into two separate lines and using a "V" guard as "a wicked business," which increases the cost by from 8 to 9 per cent.

Enough has been said to indicate that all is not well for the cheap and abundant electricity supply. That safety is desirable everyone will agree. Nothing could be more detrimental to the electricity business than repeated fatal accidents caused by people receiving shocks from broken overhead wires; nothing would bring more discredit on the electrical profession than such catastrophes. Bare overhead lines must not be erected so that telegraph or telephone wires can make contact with them or so that rough weather is likely to result in live wires being strewed along the highway; but it ought to be possible to secure adequate safety with more simple and less expensive arrangements than those which electrical engineers are at present compelled to provide. Although restrictions in other countries are less severe than they are in Great Britain, accidents rarely occur, or if they do happen, they are not heard of here. We have in this country many miles of bare overhead wires running over main streets, which, by means of trolley wheels running over them, supply electric current to tramcars and trackless omnibuses. Sometimes, but very rarely, these wires break and fall to the ground; but it is seldom, if ever, that anyone is killed or even injured, notwithstanding that the pressure on these overhead traction conductors is something like 200 volts greater than that usually applied to the lines that supply current to villages and other places. The hardships of the existing regulations seem to be most keenly felt when dealing with genuine rural supplies. That, at any rate, seems to be the experience of Mr. W. Fennell, who finds that the existing rules are quite reasonable when applied to main transmission lines. When it comes to dealing with genuine rural supplies with a low load density, however, the regulations are

found to be a very real hindrance to making money. In rural areas which might be supplied from Mr. Fennell's station the income from the lines would not in many cases exceed £50 per annum until the farmer adopts electrical methods of cultivation, and if a line were to cost anything more than £200 the scheme would be unprofitable. Under existing conditions Mr. Fennell can just run a single-phase 3300-volt line for about £260 and a four-wire distribution system for approximately £400, so that at present rural electrification is impossible. Much attention is now being paid to this important question of reducing the cost of overhead lines. British engineers visit the Continent and continental engineers come here. There are innumerable discussions and conferences and lectures, which show what a glorious thing rural electrification is, but the main obstacle to progress remains. Naturally there is diversity of opinion concerning the question of how rural electrification should be carried out. Some engineers say that the farms should be supplied with single-phase current; others advocate three-phase current; there also seems to be a little uncertainty as to what voltage to employ on the farms. The few engineers who are at present embarking upon genuine rural electrification schemes are doing so in accordance with their own ideas; but some day the Government may decide that all rural electrification equipment must be standardised and that equipment which does not conform with the standard must be scrapped, just as it has been decided that single-phase railway equipment must be scrapped.

It is pretty evident that if the Government really desires to see this country fully electrified it must pay attention to other matters besides erecting super-power stations and interconnecting them. If there is no intention to abolish the present regulations or to assist the supply people in the matter of wayleaves, then engineers are wasting their time in endeavouring to supply cheap current to farms. If, on the other hand, the Government is prepared to consider schemes that are cheap and reasonably safe, then the position is more hopeful. Mr. F. H. Clough, of the British Thomson-Houston Company, has brought to our notice a system of rural distribution which might possibly meet the case. On the farm, he argues, it seems desirable that the farmer should be able to make his own connections and not have to send into the nearest town to get an electrical expert to make small alterations to his wiring. On this account the highest permissible pressure to earth would have to be in the neighbourhood of 100 volts; consequently if the farm were given a three-phase supply the voltage between lines might conveniently be 200 volts, giving 115 volts between any one line and the neutral which would be earthed. In the interests of safety it is also desirable that in the event of a short circuit the power liberated should be low, and these two considerations—low voltage and low short circuit power—call for a small transformer on each farm. The lines bringing the power to the farm would work at, say, 2200 or 3300 volts. Feeder lines operating at the latter pressure could cover distances of from 5 to 7 miles with a reasonable voltage drop when supplying a load of, say, 2 or 3 kilowatts per farm and, say, two farms to the mile. The supply to these feeders or rural lines would be given at suitable sub-stations fed from the main trunk cables. For supplying these rural lines the transformers would preferably be small. A 6-mile line having a total connected load of about 30 kW might be supplied by a 15–20 kW transformer, so that the short-circuit energy for the line would be limited to that of the transformer, thus enabling simple plug fuses to be used for protecting the individual transformers on the farms. This system of distribution is very similar to that used in many of the American and Canadian districts. The rural lines may be considered as a modification of the existing telephone lines in the country, but with three wires instead of two and with a rather larger cross section of copper. For the case cited Mr. Clough advocates copper conductors weighing 150 lb. to the mile, supported on posts 26ft. long, measuring 5in. at the top and 6¾in. at the base, spaced 180ft. to 200ft. apart. Such a line would not comply with the existing regulations governing ice and wind loading, but it would carry about ten to twelve times the normal fair-weather load. A severe storm, which may occur every two or three years, might cause the line to break, thus making it necessary to ensure that in falling a broken wire would cause a short circuit, and in accordance with Mr. Clough's scheme this would be done by transposing the wires in somewhat the same way as telephone wires have been transposed in order to reduce inductive interference. Under favourable conditions a line constructed in this manner might cost about £100 per mile, or, say, £150 per mile, including step-down transformers for two farms per mile. This would give a capital cost per kilowatt of demand at the farms of about £25, to which should be added the capital cost of the power station, main trunks, &c. Allowing for suitable diversity factors, this would be about £15, making a total of £40, and if an annual charge of 15 per cent. be allowed to cover interest, depreciation, profit, &c., the capital charge would be brought to about £6 per kilowatt of demand, which is comparable with the tariffs for more densely populated areas. With a cheap construction and tariff which gives a reasonable return on the capital outlay it would be possible to charge a low price for the energy supplied, say, in the neighbourhood of a penny per unit, and this might encourage the farmers to make extensive use of electricity for heating and other purposes. Doubts may exist as to whether lines erected in this way would be sufficiently safe; but, according to what Mr. Clough tells us, falling wires would invariably cause a short circuit. Whether the scheme is ever likely to prove acceptable to the guardians of the public safety we do not know. Certain it is that the existing arrangements are much too costly, and unless something different is adopted there seems to be little prospect of really cheap current ever being delivered to rural parts.

The Indian Monsoons of 1926.

The monthly supplements to the Indian Daily Weather Reports, provide, as in previous years, the information from which a brief account of the monsoons may be prepared, by noting the main features and the most important details and results.

For the account of the South-West Monsoon the summary published in October provides a basis, the information here added from the monthly supplements being chiefly such as is interesting to engineers. The account of the North-East Monsoon is similarly compiled, but from the monthly supplements only. A few notes relating to crops have been interpolated.

Conditions Precedent to the South-West Monsoon.

In the three months preceding the breaking of the South-West Monsoon, western disturbances produced rainfalls much in excess of the normal. In March there were unusually heavy rains in northern and central India, amounts in excess of the normal, including 2·28in. in Assam, 2·34in. in Behar and Orissa, 2·07in. in the United Provinces, 1·63in. in Bengal, and 1·05in. in the North-West Frontier Province. In April there was "copious rain" from the north-west frontier to the east United Provinces, but the expression is merely relative, the normal falls not being exceeded by more than 1in., except in the Central Provinces, 1·26in., and the North-West Frontier Province, 1·16in. Similarly, the "large excess," in May, over north-west India and the central parts of the country only attained, when averaged over whole provinces, 0·96in. in the Punjab, 1·04in. in the Central Provinces, and not more than 0·50in. in other provinces. In these three months maximum temperatures were in defect by more than 2 deg., taking the mean for the period, and cloud in excess by nearly 0·5 hour.

The South-West Monsoon.

About the end of the second week in May, 1926, a temporary advance of the monsoon occurred in the south-east of the Arabian Sea. It brought heavy rain on to the west Ceylon coast and to Malabar on the 14th, Colombo reporting 10in. and Trivandrum 11in.

The monsoon was, on the whole, weak in June, but appreciably more active in the other three months. The season's rainfall was normal or in excess in all divisions, except Hyderabad, where there was a defect of 19 per cent.

The largest excess in the June to September rainfall was in Bombay, 9·2 per cent. The excess in Rajputana was 8·0 per cent., in Sind 5·8 per cent., in the Punjab 5·6 per cent., and for all India 3·6 per cent.

June.—The Arabian Sea Monsoon was established on the west coast of the peninsular by the 8th, or five days later than usual, and in the interior of the peninsular between the 15th and 20th, reaching Gujerat and Rajputana towards the close of the month. This branch of the monsoon was weak, and rainfall much in defect over the northern half of the peninsular, in the central parts of the country and in north-west India. The Bay Monsoon was also weak, except in Burma and Assam, rainfall being in large defect in north-west India and the United Provinces. Averaged over the plains of India, the month's rainfall was in defect by 2¼in., or 28 per cent.

July.—At the beginning of the month a depression passed over north-east India and the central parts of the country to Rajputana, and about the 13th another passed from Orissa to the United Provinces, both bringing good rains. The month's rainfall was copious over a tract of country from the Punjab to Assam, also in Gujerat, while in most sub-divisions of the peninsular and central parts of the country the month's total was within 25 per cent. of the normal. It was in moderate to large excess in north-east India, the United Provinces East, the Punjab, Gujerat, and the Madras Coast North; and in moderate to large defect in the Bay Islands, the North-West Frontier Province, Baluchistan, Sind, Central India East, and Madras South-East. Averaged over the plains of India, the month's rainfall was in excess by 1·70in., or 14 per cent.

August.—The Arabian Sea Current continued active in August, producing widespread rains in the peninsular, the central parts of the country and the tract from Gujerat to the east Punjab, between the 6th and the 11th. Between the 13th and the 20th there were abundant rains from Bengal to central India. The principal feature of the rainfall distribution over the country was a large excess in the tract from the Punjab East and North to Sind and Gujerat, in the Central Provinces, and in the Konkan and the northern half of the Deccan. The greatest percentage deficiency, 39 per cent., or 1·70in., occurred in the Madras Deccan. Averaged over the plains of India, the excess was 25 per cent.

September.—A disturbance which passed from south-east Rajputana and through north Gujerat into Sind between the 1st and 6th brought heavy rain. The month's rainfall was unusually heavy in north-west India, excluding the Punjab and Kashmir, the 10 per cent. excess in the former being, in amount, only 0·28in. and the 22 per cent. excess in Kashmir 0·32in. In the Punjab the sowings of cereals and oil seeds depend on the September rains, the sowings of the former beginning when the ground suits, about the middle of October. Under the hills north of the irrigated belt are large areas protected by wells, but depending on timely rainfall for good crops. The large excess of 101 per cent. in the North-West Frontier Province was only 0·69in. in amount. In Sind the fall was 5·73 against the normal of 0·41; in Bombay, 11·22in., against 6·02, or 86 per cent. excess; in Rajputana, 7·75, against 3·05, or 154 per cent. excess. In central India the excess of 106 per cent. corresponded to the important amount of 6·02in., the rainfall for that division being 12·42in. The month's rainfall was in moderate to large defect in Assam, Berar and Hyderabad. In sub-divisions, there was moderate to large excess in Malabar, 42 per cent.; Chota Nagpur, 32 per cent.; the Punjab South-West, 33 per cent.; Central India East, 190 per cent., or 18·47in., against the normal of 6·37in.; and Central Provinces West, 53 per cent. Averaged over the plains of India the excess was 19 per cent. The good rains in the Punjab South-West—August only 10 per cent. defect, July 32 per cent. and September 33 per cent. excess—were especially welcome, as this is an area liable to scarcity and famine, being inadequately protected by irrigation.

The North-East Monsoon.

September.—The conditions generally having already been noted, mention may be made of disturbances heralding or occurring within the period of the reversal of current. Such were a depression which passed over South Bengal on the 1st and moved westward through Bihar, the United Provinces, and South Rajputana, disappearing over Sind on the 9th. Also a depression which, developing into a storm, crossed the Orissa coast on the 16th–17th, moved to the Central Provinces and disappeared into the hills of the east United Provinces and Bihar on the 24th. It caused abundant rains in the peninsular and Gujerat and very heavy rain in Orissa and on the north Madras coast. Rainfall was widespread from the 17th to 19th from north-east to central India; fairly heavy rain fell in the United Provinces and Central Provinces on the 22nd, and there were a few heavy falls in Bihar and the United Provinces East on the 23rd and 24th. A low-pressure area normally associated with a reversal of the pressure distribution over India and with the retreat of the South-West Monsoon appeared in the Bay on the 27th. This was associated with scattered showers in the peninsular and a temporary appearance of the North-East Monsoon in Madras.

The North-East Monsoon.

The rainfall in Madras having been 5·87in. in June, or 19 per cent. in defect; 8·31in. in July, or 15 per cent. in excess; and 5·72in. in August, or 8 per cent. in defect, the conditions up to September were nearly normal. The situation was unaltered during September, the rainfall of that month being 6·04in., or 8 per cent. in excess.

October.—During the month the North-East Monsoon was weak on the whole. In the south of the peninsular there was thunderstorm rain in the first three days, and again from the 9th to the 18th. Mangalore recorded 6in. on the 11th. On the last three days of the month the monsoon strengthened in south-east Madras, Madura recording 5in. on the 30th. In Madras the month's rainfall was 6·05in., or 25 per cent. in defect; in Mysore 5·07in., 9 per cent. defect; in Burma 13·85in., 88 per cent. excess;

in Assam 8·58in., 77 per cent. excess; in Central India 3·30in., 173 per cent. in excess of the normal rainfall of 1·21in. Averaged over the plains of India, the month's rainfall was 15 per cent. in excess.

November.—Over the south of the peninsular the weather was almost dry after the 8th. There was some strengthening of the monsoon in the Bay of Bengal towards the end of the month. A depression, 22nd to 26th, brought heavy rainfall in the south-west of the Bay, and very heavy rain fell in Burma, 23rd to 26th. Apart from this the rainfall in Burma was confined to occasional scattered falls. There was unusually heavy rain in Iraq, nearly the whole of the average annual fall being recorded in November, 1st to 20th. The rainfall in Burma was 5·41in., or 89 per cent. in excess; in the sub-division Upper Burma it was 6·84in., or 286 per cent. in excess of the normal, 1·77in. In Madras the total for the month was 3·91, or 41 per cent. in defect.

December.—The North-East Monsoon was extremely weak in the south of the peninsular, and the one storm which traversed the Bay of Bengal diverted general rainfall towards north Burma and north-east India. Scattered falls occurred in the south of the peninsular between the 6th and 8th, when Coimbatore recorded 1¼in. in twenty-four hours; also between the 13th and the 20th, where Pamban received 4¼in. in forty-eight hours; and again at a few stations towards the close of the month. The storm mentioned above caused heavy rains in south Bengal, Assam, and Upper Burma. The Madras rainfall of the month was only 0·81in., or 69 per cent. in defect. The normal mean for India being only 0·54in., the defect of 43 per cent. is insignificant. The only sub-division in which a rainfall of any importance was recorded was the Bay Islands, 22·08, the normal being 6·91. It may, however, be worth noting that Chota Nagpur received 1·13in., the normal being 0·19in., since the rainfall of January, 1927, was also in excess in that sub-division, 1·25in., as against the normal 0·72in.

HEAVY RAINFALLS: INCHES IN TWENTY-FOUR HOURS.

April.—Chittagong, 7in.

May.—At Colombo, 9·54.

June.—In Lower Burma, Kyaukpyu, 9·06; Tavoy, 7·15; in Bengal, Jalpaiguri, 7·40.

July.—In Upper Burma, Myitkyina, 7·44; in Bengal, Chittagong, 7·65; Jalpaiguri, 7·72; in Orissa, Balasore, 6·03; in Bihar, Darbhanga, 7·86; in Gujerat, Ahmadabad, 7·55; in Central Provinces, West, Jubbulpore, 5·48.

August.—In Lower Burma, Akyab, 10·10; in Bengal, Chittagong, 8·35; in Orissa, Balasore, 7·50; Cuttack, 6·55; in the Punjab East and North, Hissar, 13·65; in Rajputana, East, Jaipur, 5·07; in Gujerat, Bhuj, 5·05; in Central Provinces, East, Raipur, 7·70.

September.—In Bengal, Jessore, 5·66; Dinajpur, 7·04; in United Provinces East, Gorakhpur, 6·61; in Sind, Karachi, 8·11; a part of a fall of 14in. from the afternoon of the 4th to the morning of the 6th, this being about twice the normal annual rainfall; in Rajputana, East, Kotah, 7·30; in Gujerat, Veraval, 10·92; in Madras Coast North, Calingapatam, 4·60.

October.—In Lower Burma, Moulmein, 5·74; in Upper Burma, Minbu, 4·25; Mandalay, 4·00; in Assam, Silchar, 4·65; in United Provinces West, Jhansi, 2·74, the normal month's rainfall being 0·87 at that station; in Central India East, Nowgong, 5·00, normal month's rainfall 1·54; in Central Provinces West, Jubbulpore, 3·56, normal month's rainfall 1·81; in Malabar, Mangalore, 5·70; in Madras South-East, Madura, 4·81.

November.—In Lower Burma, Kyaukpyu, 4·55; in Upper Burma, Minbu, 4·13; Lashio, 10·00, normal month's rainfall 2·75; in Madras South-East, Cuddalore, 6·13; Madras City, 4·42; in Madras Coast North, Nellore, 4·09.

December.—In Madras South-East, Pamban, 2·97; Negapatam, 1·65.

January, 1927.—In Madras South-East, Tinnevelly, 1·79; Pamban, 1·20; Negapatam, 3·66; in Madras Coast North, Cocanada, 1·52; Vizagapatam, 1·91.

At Hill Stations, excluding Kashmir and Baluchistan, Cherrapunji, in June and again in October, nearly 15in.; in July, nearly 19in.; Shillong, 8·00 in July; Mount Abu, 14·37in. in September, all in twenty-four hours.

Month's Rainfalls at hill stations, Cherrapunji, June 123in., July 117in., August 50·6in.; Mussooree, in July and in August, 41·4; Mercara, July 49in.

FLOODS.

In July disastrous floods occurred in the Myitkyina district of Upper Burma, causing much loss of cattle and crops. Streets were flooded in Bombay after a fall of 5in. on the 8th and at Calcutta after 7in. on the 21st. In August there were extensive floods in the river valleys of Bengal and Burma, notably in the Midnapore district and in the Pegu and Jharrawaddy districts. There were breaches of the railway lines and interruptions of telegraphic communications. It was reported that hundreds of houses collapsed, and that there was damage to crops. The Indus was in heavy flood in Sind. In September there were extensive floods in Burma, Orissa, central India, Kathiawar and lower Sind. The floods near Karachi were very devastating, newspapers estimating the loss of property at 2 crores of rupees. Floods were also heavy in the Jubbalpore district, and at the Nerbudda bridge, which was damaged, the water level was, it is stated, 30ft. higher than any recorded since the bridge was built in 1864. In October a depression, 15th to 18th, brought heavy rain in Burma; railway lines were breached and telegraphing interrupted. In November it was reported that the Baghdad–Basra railway had been breached in several places. In Iraq nearly the whole normal annual rainfall fell in the first twenty days or so of the month, trans-desert traffic being held up for about three weeks.

WINDSTORMS.

The opportunity is taken of including in the present summary some notes of storms which occurred before the monsoon season. In March a gale at Comilla blew down many houses. In the same month a disturbance in northern India caused a storm at Calcutta, a terrific hailstorm at Nagpur and Kamptee, which caused much damage to property, and a storm which passed over several villages in Narayanganj sub-division of the Lahore district, rendering homeless hundreds of families. It also gave rise to a severe thunderstorm at Karachi, by which three sepoys were killed, to a tornado at Jhansi, which devastated the crops and damaged many strong buildings; and to a hurricane at Maymyo, which did similar damage. These storms occurred between the 6th and the 15th. On the 24th some of the hailstones which fell during a hailstorm at Jubbalpore were 2in. long. In the Madaripur sub-division of the Faridpur district, a severe tornado and a waterspout on the river rendered 400 families homeless. In May a storm at Calcutta caused some damage to shipping and the loss of several lives.

In June a remarkable dust and thunderstorm passed over the railway line about a mile from Charrand, on the 6th, capsising all the vehicles of a mixed train, except the engine. A severe storm at Dhanduka, in Kathiawar, caused considerable damage to cattle, trees and buildings, and blew a number of railway coaches 4 miles along the line, finally derailing them. A similar storm is reported to have upset nine coaches on the Howrah–Amta railway. In September there were a number of severe gales on the coasts, one of which is reported to have capsized a country boat drowning 170 persons, while another drove the steamship Revati ashore on a sandy beach in the Gulf of Cambay.

A Heat Wave.—It was reported in the Press that in Shirpur Taluka, West Khandesh, a wave of hot air, 2 miles in length, advanced rapidly from the Satpura Hills, and utterly destroyed the standing crops. Persons working in the fields in the affected area were overcome by the heat.

Literature.

The Practical Design of Irrigation Works. By W. G. BLIGH, M. Inst. C.E. Third edition, revised and brought up to date by F. W. WOODS, C.I.E., M. Inst. C.E. London: Constable and Co., Ltd. 1927. Price 42s.

SINCE this is a third edition of an important work, it is not necessary to describe the general character of the contents, which is correctly indicated by the title. The first edition was the subject of criticism, which was taken into consideration by the late author in preparing the second edition, the most conspicuous case being the study of the stability of weirs founded on sand. To independent critics Bligh's work may have seemed to have had greater importance than was, at first, apparent to his compeers, for its author's originality and brilliance, though they led him at times to skate on thin ice, were such as to impart to his work some of the qualities lacking in other books on irrigation. Moreover, the practical designer of irrigation works needed the help afforded by plain directions for calculation and design, as a change from the method of staging a march-past of conflicting theories. The present significance of these considerations is due to the fact that the book still holds a place of its own in the literature of the subject.

The chapters relating to gravity dams and weirs, single arch dams, and multiple arch dams, were recast and rewritten for the second edition, which the author revised and brought up to date, a notable addition being seven pages relating to the irrigation of the Canadian Pacific Railway in Alberta. In the work of preparing the book for the third edition, the publishers have been fortunate in securing the services of Mr. F. W. Woods, who was chief engineer of the Punjab irrigation works from 1917 to 1921. The fourteen pages of notes which he has added to Chapter VI., Diversion Weirs on Sand Foundations, extend the discussion and provide further data, the examples chosen for this purpose being cases of damage suffered by the Narora Weir, on the Ganges, and the Khanki Weir on the Chenab, and the tests of hydraulic conditions at the Jhelum Weir at Rasul. Fourteen useful figures are employed to elucidate the text of these notes. This new matter enhances the value of one of the most important chapters in the book. It should be read in conjunction with paragraphs in Mr. Wood's preface, p. vi., l. 11, to p. vii., l. 4, in which is clearly disclosed the difficulty of forming and fixing opinions on some vital points.

The opportunity to provide the reader with Mr. Woods' own opinion of Bligh's work, as he expresses it in the last paragraph of his preface, cannot be withstood. He writes:—"In conclusion, the editor desires to make it clear that Bligh's treatise is, in his opinion, an admirable and useful work, all things considered, and a monument to the credit of the industry and acute judgment of its author. That does not mean that there is not a great deal in it which the editor is not in full agreement with—especially in Chapters V. and XIII.—on which he would not have preferred to express opinions somewhat differently; but it has been considered desirable, as a general rule, not to interfere greatly with the text of the author; and, apart from matters of detail, here and there, to express dissent, if at all, only in editorial footnotes, or in notes appended to each chapter." Though the second sentence appears to have escaped verbal correction, its purport, as distinct from its formal meaning, is quite clear, and irrigation engineers of the Indian Public Works Departments will appreciate its significance. As regards the chapters cited, it may be assumed that in the case of Chapter V., Hydraulic Formulas, it is a matter only of a preference for a different expression. Chapter XIII. Design of Channels, is on a subject which cannot be treated so as to conform in any respect with more than one of the divers opinions held by those who pursue the elusive mathematical solutions of problems of flow; while if also the study were extended to cover all cases of crop requirements, a whole book would be needed for its presentment.

While the success of the second edition, of which there was a second impression in 1912 and a third in 1925, shows that the bulk of the present volume is already a well-esteemed work, it will be recognised that Mr. Woods has handled a difficult task with tact and judgment, and has considerably increased the value of the book, which, with its 425 large pages, in which there are 418 illustrations, will be of great value to those who are entrusted with the design of irrigation works.

SHORT NOTICES.

Magneto Manual. By H. R. Langman. London: Crosby Lockwood and Son. 7s. 6d. net.—The author of this book is instructor and lecturer in magnetos at the Royal Air Force Technical Training School at Halton, Bucks. He makes no attempt to describe the construction of any particular magneto throughout, but deals with the outstanding features of the best types in everyday use. The text is supplemented by special diagrams made by the author, many being original and unconventional. The book will be appreciated by students and apprentices who wish to acquire a thorough knowledge of the theory of electro-magnetic induction and of the components of the principal types of magneto apparatus. The chapter on the timing and setting of magnetos for engines up to sixteen cylinders, like those of the "Napier Cub" and other well-known aircraft engines, is specially interesting.

The Petrol Engine. By the Staff of *The Motor.* Second edition. London: Temple Press, Ltd. 3s. 6d.—This is a handbook and practical guide to the construction and uses of the petrol engine in its many modern types. It comprises over 270 pages of text and is divided into fifteen chapters. The opening chapter deals in a very interesting manner with the history and development of the petrol engine from the earliest types and is followed by chapters devoted to motor car, motor cycle, commercial vehicle engines, aircraft, motor boat and marine engines, and petrol electric lighting sets. A feature of the book is the almost complete avoidance of mathematical formulæ, and the writers have dealt with their subjects in a manner which can be readily understood by readers with little engineering training. To such the chapter on hints on timing of multi-cylinder engines will be most welcome.

BOOKS RECEIVED.

Human Nature in Business. By F. Creedy. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 12s. 6d. net.

Castles in the Ether. By J. W. Cloud. London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 4, Stationers' Hall-court, E.C. 4. Price 21s. net.

The Science of Road-making. By J. W. Green and C. N. Ridley. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 10s. 6d. net.

Co-operative Production: The Priestman-Atkinson System. By H. Atkinson. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 12s. 6d. net.

Mathematische Hilfsmittel für Techniker: Differential und Integral Rechnung. By A. Deckert and E. Rother. Wittenberg (bez Halle): A. Ziemsen Verlag. Price 7·50 marks.

Institution of Municipal and County Engineers—Handbook, 1927–28. London: Published by the Institution, 92, Victoria-street, Westminster, S.W. 1. Price 5s. to non-members.

The Propagation of Electric Currents in Telephone and Teelgraph Conductors. Fourth edition. By J. A. Fleming. London: Constable and Co., 10–12, Orange-street, W.C. 2. Price 21s. net.

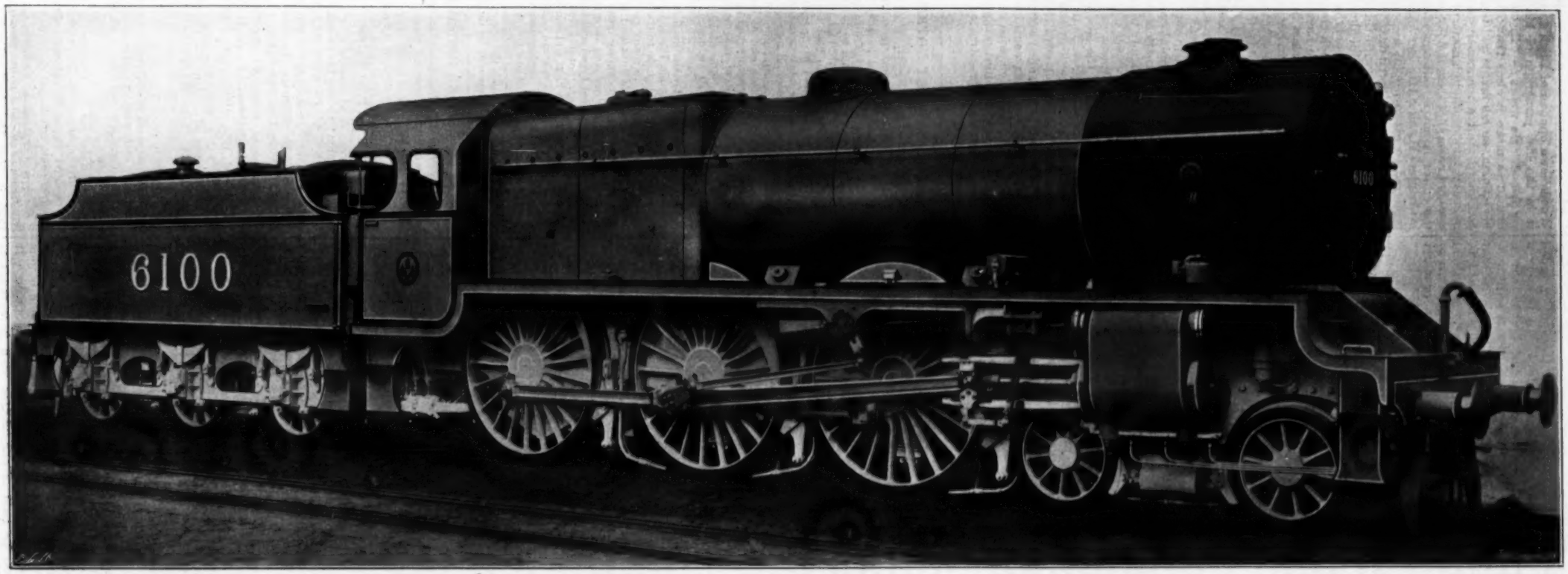
Safety Rules for the Installation and Maintenance of Electrical Supply and Communication Lines. Washington: The United States Government Printing Office, U.S.A. Price 60 cents net.

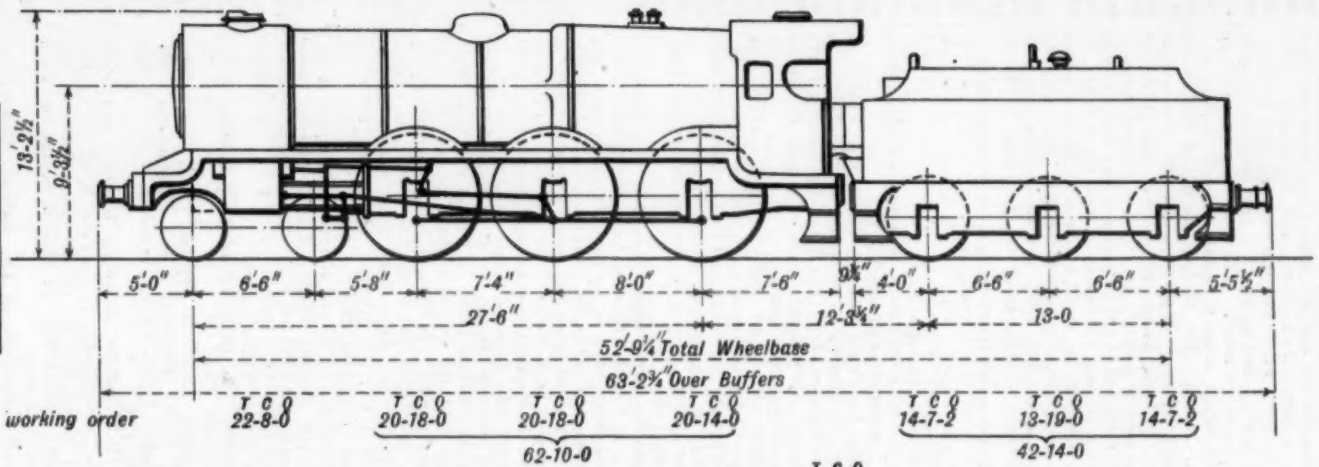
Glasgow Corporation Tramways—Account of Revenue and Expenditure and Balance Sheet for the Year June 1st, 1926, to May 31st, 1927. Glasgow: Published by the Corporation Tramways Department.

L. M. AND S. RAILWAY — THREE-CYLINDER EXPRESS LOCOMOTIVE "ROYAL SCOT"

BUILT TO THE DESIGNS OF SIR HENRY FOWLER, K.B.E., BY THE NORTH BRITISH LOCOMOTIVE COMPANY, LTD., GLASGOW

(For description see opposite page)





Boiler Pressure	250 lbs per □"
Heating Surface:–	
Tubes	1892 sq. feet
Firebox	189 ,, ,,
Total	2081 ,, ,,
Superheater	445 ,, ,,
Grate Area	31·2 ,, ,,

Cylinders:–	
Number	Three
Diameter	18 ins.
Stroke	26 ins.
Diameter of Coupled Wheels	6'-9"
Tractive Effort at 85 B.P.	33150 lbs
Tender Water Capacity	3500 galls.
,, Coal ,,	5½ tons

"THE ENGINEER"

SWAIN SC.

L.M.S. Rly. Three-cylinder Express Locomotive.

THE Royal Scot locomotive illustrated on the opposite page is one of fifty three-cylinder express locomotives which are being built by the North British Locomotive Company, Ltd., to the designs of Sir Henry Fowler. They are intended especially to work the heavy Scotch expresses, and at 85 per cent. of the boiler pressure will develop a tractive effort of 33,150 lb. The three-cylinders are 18in. by 26in., and each of them has its own Walschaerts valve gear. The boiler is interesting, for it is made for the exceptionally high pressure of 250 lb. per square inch. The total heating surface is 2081 and the grate area 31·2 square feet. The fire-box is rather long, 10ft. 3in., but is provided with a drop grate in order to remove the difficulty of dropping the fire.

Other particulars which are available at the present moment are given on the weight diagram and the tables which adjoin it.

Trend of Water Purification Practice.*

By PAUL HANSEN, Consulting Engineer, Chicago.

THE following paper, which was recently read before the Canadian Section of the A.W.W.A., is interesting as setting out the views of waterworks engineers on the other side of the Atlantic.

WITHIN the last twenty-five years water purification works have been installed at increasing rates, and undoubtedly we will see a great many big plants installed in the near future. Any city with a defective water supply must be regarded as backward.

It seems to me that the outstanding development and event in connection with water purification in recent years has been the acceptance of a standard of purified water. That standard is what is known as the United States Treasury standard. It demands now, according to the latest revision of that standard, not more than one B. coli per 100 c.c. in the purified water. That has done more than any one thing to crystallise and define water purification practice.

Among other things it has made us realise that filtration alone is not adequate. We already knew that sterilisation with liquid chlorine or by any other means is not adequate alone, and that it takes a combination of these two to give us an acceptable water according to the modern standard. Also it has served to make a comparison between the performance at different purification works, and has a tendency to check up operators of plants who are inclined to be somewhat lax in the operation of their works.

DEGREE OF "PERMISSIBLE" POLLUTION.

Another thing it has done, and one which you will hear a great deal more of in the future, is that it has enabled us to secure a knowledge of the degree of pollution that is permissible in raw water. The first expression of that degree of pollution was given by a committee of experts called in by the International Joint Commission on boundary waters. On the basis of statistical evidence they expressed the opinion that raw water should not contain more than 500 B. coli in 100 c.c. Water more polluted than that was too polluted to be purified. Later on there was an investigation by Streeter, of the United States Public Health Service, who made a statistical study of some twenty-five water purification plants, involving filtration and sterilisation, in the Central West. These statistics were presented to the *Journal* of the American Waterworks Association, and showed that there was a definite relation between the quality of raw water and the quality of filtered water, and indicated that the pollution of the raw water should not exceed 650 B. coli in 100 c.c.

Streeter pursued his studies further by making an extensive study of some ten water purification plants on the Ohio River, and by building an experimental water purification plant at Cincinnati. These further studies indicated that filtration alone could not handle water successfully and produce an effluent equal in quality to the Government or "United States Treasury" standard. With liquid chlorine sterilisation following filtration it was possible successfully to purify water with a B. coli bacilli content of from 5000 to 6000 in 100 c.c.

Where plants were elaborated to include double coagulation and double sedimentation, filtration and sterilisation, it was possible to handle raw water containing about 10,000 or possibly more B. coli bacilli in 100 c.c. And if we would still further elaborate the process so as to include secondary filtration, possibly of the slow-sand type, and so on, we might be able to handle water containing as high as 50,000 B. coli.

RELATION OF SEWAGE TREATMENT AND WATER PURIFICATION.

Now all this raises the interesting question of how far we are going to go in permitting the use of polluted water and how far we will have to go in the elaboration of our water purification plants to meet that pollution. Also what are we going to do about limiting the pollution of streams by requiring municipalities to put in sewage treatment plants? In other words, the time has come when many of the streams, both in the United States and Canada, are being polluted to such a degree that we have got to consider co-ordination between sewage treatment and water purification.

Just what that co-ordination will be, is something that will have to be given a great deal more thought and study. At the present time there is no crystallisation of opinion on this subject. The general impression seems to be that we cannot go on indefinitely elaborating water purification processes and that there comes a time when the æsthetic sense of the community rebels against pollution in raw water.

Another matter that we have to consider is how efficient purification plants may be in removing that pollution.

* Paper read before the Canadian section of the A.W.W.A.

At Albany, N.Y., water pollution became so great that they had to elaborate their purification to include preliminary chlorination, coagulation, sedimentation, rapid sand filtration, slow sand filtration, and finally sterilisation. Even though they were able to produce safe water, public sentiment has condemned the system and has demanded expensive measures to lessen the pollution.

It is generally difficult to co-ordinate sewage treatment and water purification, because there is no adequate central control governing the two things. Usually the municipality upstream pollutes the water supply of the community downstream. They are usually not disposed to put in sewage treatment works until the community in the downstream direction forces them to do so through the activity of some State agency.

There are a few cases where a group of communities may undertake to consider economical co-ordination between sewage treatment and water purification. That situation applies largely to cities taking their water supply from the Great Lakes. These cities generally discharge their sewage into the lakes and obtain their water supply from the lakes. They have what you may call the rotary system.

It is necessary sometimes to purify both the sewage and the water supply, and the question arises as to just what it is economical to do. Sometimes municipalities on a given stream may group together in order to handle these inter-related problems.

COMPARATIVE COSTS.

In order to leave a few thoughts on this subject, I might mention that sewage purification as a means of protecting water supplies is generally more expensive than water purification. Broadly speaking, complete sewage treatment which produces a clear effluent will cost not less than 9 dollars per capita, and may cost more than that, whereas water purification will probably not cost more than 4 dollars or 4·50 dollars per capita. The most elaborate process of water purification will cost not more than 10 dollars per capita. It would seem at first blush as if the tendency should be towards water purification as being the cheaper method of securing the best results, and it is more or less an open question as to which one we are going to hear a great deal more about in the future. It is about time we began thinking of it more seriously.

NEW IDEAS IN WATER FILTRATION PRACTICE.

Another series of items that I would like to consider are in connection with the details of design and operation of water purification plants.

There have been some advances in the method of using coagulation, more particularly with reference to the control by means of observing the hydrogen-ion concentration of the water. It has proved to be a perfectly practical method of maintaining control over the application of coagulant.

Another question that is confusing the minds of waterworks men is the matter of the preliminary treatment of water with coagulant. It is generally recognised that after coagulant is added to the water it must be thoroughly mixed. There must be an intimate mixture of the chemical with the water. There is no agreement on just how that mixture can best be obtained—whether by waterfall effect, exemplified by the hydraulic pump, or by a stirring device, or by a baffling arrangement; nor is there an agreement as to the length of time. There seems to be a tendency of opinion in water purification practice to consider that the important thing is to get a thorough intimate mixture at the start, and that the subsequent mixture is not important. Nevertheless, it is probable that there should be a continued mixing of a gentle sort, but for just how long a period is not clearly known; probably from ten minutes to half-an-hour, but it actually takes longer than that sometimes for coagulation to form. However, it is not of vital importance in securing results.

Then we have sedimentation. There is quite a little to be learned about this. It has generally been by guess, and varies from two hours to six hours. We do not know just what period is necessary. It varies with different waters. There is much to be learned in the shape and arrangement of the basins. Generally we have departed from scientific processes in designing these, in favour of economic construction.

It has been found that double coagulation and double sedimentation is very efficacious, and greatly increases the efficiency of the filtration works and at the same time permits economy in the use of the coagulant.

Then there is the question of dealing with very muddy water and the removal of sediment. Generally it is done in a sedimentation basin equipped with devices for removing the sediment as rapidly as it forms. That is not a matter that concerns Canada much, except in the Central West.

THE UNDER-DRAIN SYSTEM.

In connection with filtration, attention has been given to the importance of the under-drain system. There has been practically no change in the general design of filtration units, nor is there any contemplated, but a good deal of effort is being made in trying to improve the under-drain system. One of the important advances in that connection is the cementing of a gravel layer in the bottom of the pit. That was first done by William Gore, at Oshawa, Ont., and has apparently worked very successfully there. Following that, Mr. Jenks, in Sacramento, California, devised an under-drain system composed completely of cemented gravel. He cemented the whole business; Mr. Gore only cemented the upper layer. Jenks used vitrified pipe. Lime is used at this place as one of the chemicals for the purification of water.

A good many of the troubles that have resulted from filtration can be ascertained by an examination by microscope, and it is probable that with the proper use of chlorine it will be possible to control the condition of the sand grains so that they will always be in operation. That is something that will greatly improve filtration during the summer, when filtration is most subject to short-run trouble, due to clogging with organisms.

FUNCTION OF THE SAND.

Then some thought is being given towards a better understanding of the function of the sand. We have gone along somewhat blindly for a number of years, using sand in a treatment as first devised by Allen Hazen, but I cannot see that there is any reason yet for changing. We have to study the characteristics of the sand from a slightly different angle than did Hazen in 1890. An effort is now being made by filter operators to determine the characteristics of the sand, not as a whole, but as it lies in layers in the sand bed; and they are taking samples at different levels, and examining that sand so that they can express its characteristics by a chart which shows the size of the grains at various depths. That may prompt us to some modification in the sand that will make for efficiency and economy.

Another thing that is being thought of in recent years, and that will be considered a great deal more in the future, is the improvement in the quality of concrete used in water purification plants. As a rule, water purification plants call for a very high grade of concrete—the very densest. That has not been given so much care as it should have been given, with the result that some plants are disintegrating, especially near the water line, and especially where you have frost on one side and water on the other. There is a tendency now in specifying the concrete to require the use of the cement water ratio as a means of securing a definite kind of concrete.

Now, as to the cost of water purification plants. We had occasion recently to examine the cost of a large number of plants, some thirty-four, built since the war. They ranged in cost from 16,000 dollars to 50,000 dollars per million gallons capacity. That is for filtration alone, and does not include the pumping station. That seems to be very widespread, but I think that a certain amount of spread is justified for a number of reasons. Some of these filter plants are being built with different water storage basins. That would naturally make a considerable spread in the cost. They are also being built with different sizes of sedimentation basins and filters. Smaller plants will cost more per million gallons than larger plants.

There is a tendency to make plants somewhat more costly than formerly, and I think that it is justified, because they have better arrangements and better means of operation.

Another great advance in filtration practice is the improvement in the operating *personnel*. We are now getting well-trained technical men, and the larger plants are better looked after than they were twelve or fifteen years ago. There has been a discussion as to licensing operators. I do not think that the time has yet arrived for licensing operators, because they might protect themselves behind that licence in a way that is not altogether desirable. But I would be in favour of giving an operator a certificate of proficiency after he has shown that he really knows how to operate a filter plant.

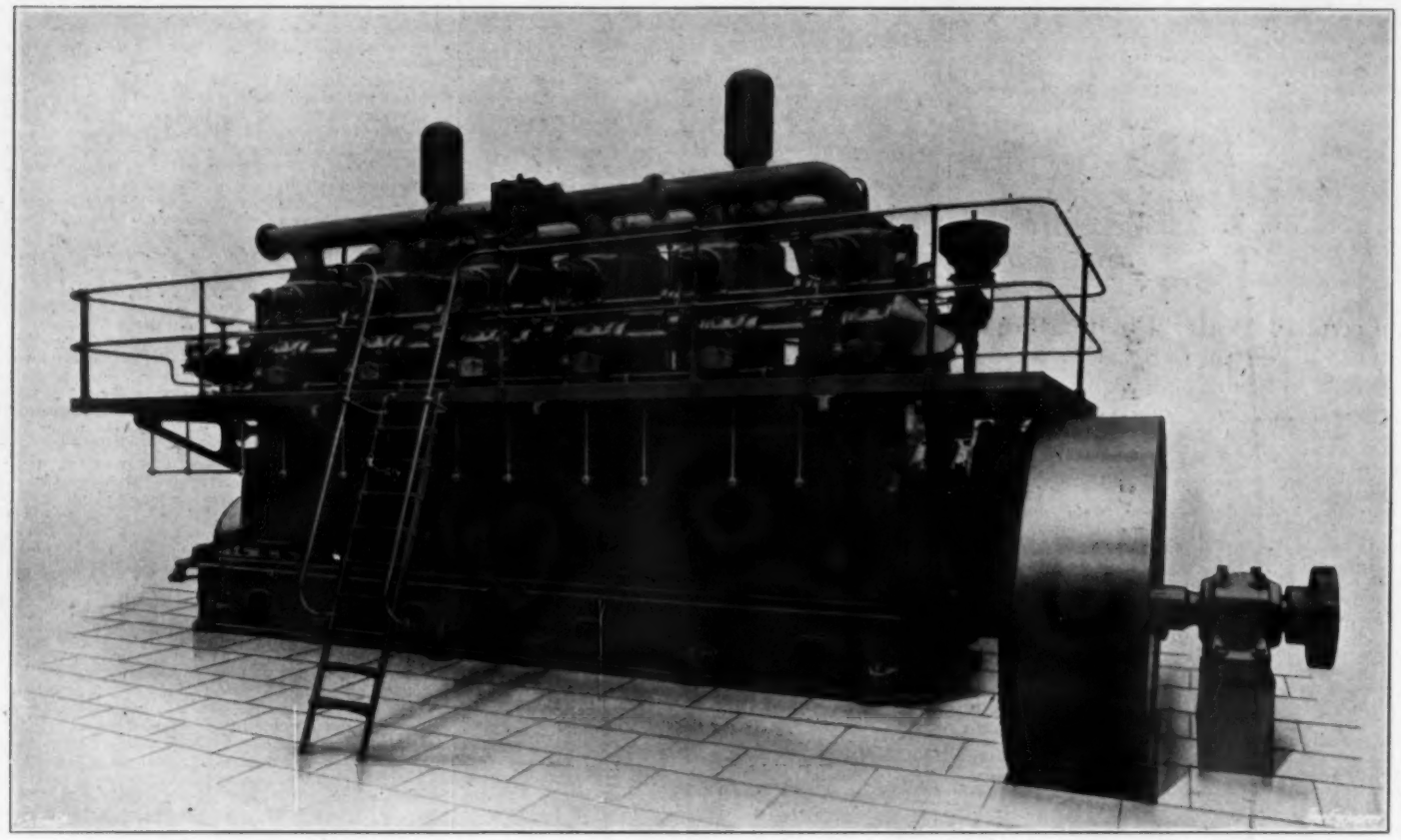
There is an increasing tendency to house filter plants in well-designed buildings. Both from the architectural and the æsthetic point of view, some of them are actually monuments to pure water. I do not wish to be in a position of advocating extravagant construction, but I think that there are certain practical aspects about the housing of filter plants in fine buildings. Not many years ago it was the custom to put them in any kind of a building, even of corrugated or galvanised iron. The public appreciate these works more now than they ever did before. I think that somebody has said that art is the striving of mankind to attain to perfection. In a way that is what we waterworks men are doing with reference to the production of good water. Therefore I presume that on that basis we are artists. And if that is the case, it seems to me that it is quite appropriate for us to house our water purification plants in beautiful, noble buildings, that typify and symbolise the most fundamental and important of all commodities, namely, pure water.

SIXTY YEARS AGO.

SIXTY years ago the educational system of this country still lingered in the age in which the monk had been the leech and the monastery gate the poorhouse. The nation had become the almoner and the practice of medicine had become a separate profession, but in educational matters we were still at the monastery gate. The school, so we wrote in our issue of August 2nd, 1867, was still a lean-to of the church; the schoolmaster, unrecognised by the State, worked under clerical supervision, the school inspectors were all clergymen. The education of the nation, in short, was in the hands of religious denominations. To those who could read the signs—and we made it our duty to see that our readers had the facts brought before them—the International Exhibition at Paris had shown that the uneducated condition of our workmen had placed our manufacturing supremacy in imminent danger. No one challenged the British workman's deft-handedness, his industry or his determination, but a serious charge could be brought against his ideas of political economy, and a still graver one against the soundness and sufficiency of his technical knowledge. Fifteen years previously the country had been suddenly awakened to "the utter want of artistic knowledge which disfigured and often rendered grotesque the forms of our unquestioned mechanical supremacy." South Kensington was the result, and although the management of that institution was subjected to hostile criticism, it was admitted that it had led to the spread of sound principles of art and an increased appreciation of the beautiful. But the provision of facilities for the scientific and technical education of the people continued to be neglected. The children of our artisans had the opportunity afforded them of cultivating their artistic abilities, but they had no place to go to to obtain instruction in mechanics, natural philosophy or chemistry. Continental nations were far ahead of us in the matter of the education of their workpeople. We had obstinately persisted in training merely the hands of our workmen. The Paris Exhibition had awakened us to the fact that our neighbours had been training their workmen's brains as well. Our existing thoroughly inefficient system of national education was, we said, on the point of breaking down. The country required a great and immediate educational reform, from which jarring sectaries would have to stand aside. The nation's half-tutored efforts were no longer equal to the strife that had been forced upon us. We fervently hoped that "the new political forces" that were then being called into being would be equal to the great national necessities which had arisen.

675 B.H.P. AIRLESS INJECTION OIL ENGINE

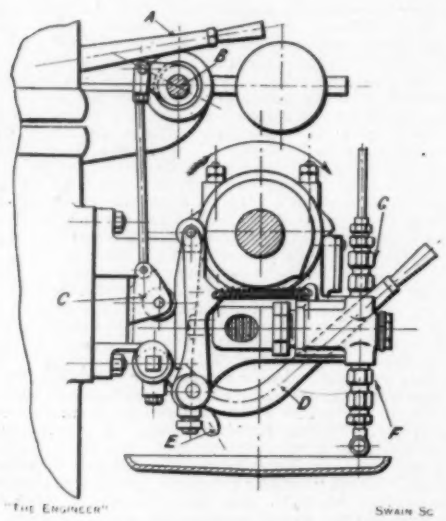
THE CAMPBELL GAS ENGINE COMPANY, LTD., HALIFAX, ENGINEERS



A 675 B.H.P. Airless Injection Oil Engine for British Columbia.

DURING a recent visit to the works of the Campbell Gas Engine Company, Ltd., at Halifax, we inspected on the test bed one of two engines which the firm has recently constructed for the Vancouver station of the British Columbia Electric Light and Power Company, Ltd. The engines will be direct coupled to 2300-volt three-phase 60-cycle alternators which have been built by the Canadian Westinghouse Company, Ltd., and are designed for an output of 450 kilowatts at 0·8 power factor when running at a synchronous speed of 225 r.p.m.

Engine Design.—As will be seen from the engraving above and the drawings reproduced on the opposite page,



FUEL PUMP CONTROLS

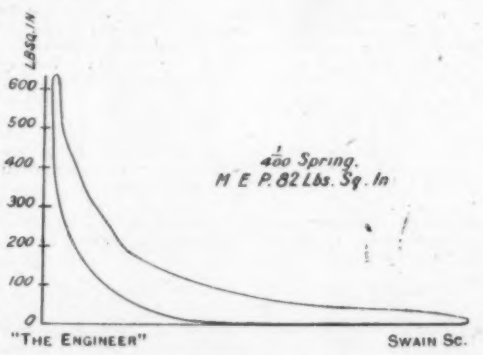
the engine is of the six-cylinder vertical type, the valve arrangement being very similar to that employed on standard horizontal Campbell oil engines. The cylinders each have a bore of 18in. with a stroke of 22in., and when running at the normal speed of 225 r.p.m. the unit has a maximum designed output of 675 B.H.P. For convenience in manufacture and also to facilitate shipment and erection, both the bed-plate and the crank case are made in two halves, which are bolted together at the centre of the engine. The bed-plate is of the box type with a central oil-tight chamber which is strongly ribbed to the outer girders. Cross members carry the seven main bearings, which are fitted with semi-steel bearing shells lined with white metal. The bed-plate is also provided with lugs to take the through bolts which pass down from the lower flange on the cylinder jackets to the bed-plate and take the working stresses of the engine.

The crank shaft is a one-piece forging, which is provided with an end extension for the lubricating pump and tachometer drive. This extension, as will be seen from the illustrations, is carried beyond the end casing to take a pulley for driving a centrifugal-type water circulating pump. Balance weights which are strapped to the crank cheeks by stirrup pieces are fitted. The crank shaft is drilled diagonally for forced lubrication and the oil is supplied by two valveless pumps which, together with the oil filters, check valves, and an air vessel, are housed in an end casing that is bolted on to the main bed-plate. The pumps deliver oil into an outside distributor from which connections are taken to the main bearings. Oil passes from the main bearings through diagonally drilled passages in the crank to the crank pins and thence up the connecting-rods to the top end bearings and gudgeon pins. The bottom end bearings are made in gun-metal and are lined with white metal, while a solid gun-metal bush is employed for the top end bearing. As will be clearly seen from our illustrations, access is given to the crank case by large vertical inspection doors which can be quickly removed, as they are suspended by rollers that run on steel runways beneath the platforms. Light steel splash guards are fitted over the crank pits so that lubricating oil is prevented from finding its way to the bottom ends of the liners which project into the crank chamber.

A wide platform runs round the engine just below the cam shaft level and is supported on cast iron brackets attached to the crank case. This gives convenient access to the valve gear. The cylinder jacket, into which the liner is pressed, is a robust casting provided with facings to take the cam shaft bearing brackets and also the brackets which support the valve levers. There is a large cooling water space between the jacket wall and the outer surface of the liner, and the cooling water enters the jacket from the bottom and is controlled by a valve built into the distributor, one valve being provided for each cylinder on the engine. The water passes up through the jacket to the cylinder cover spaces and leaves the cover near to its centre through a pipe which discharges into an open tun-dish connected to the return cooling water main fixed at the back of the engine. Each jacket is provided with inspection doors and a drain cock.

Pistons and Cylinder Covers.—The pistons are of the usual trunk type with a double head, the inner crown of which prevents the heat from travelling down the main walls of the piston to the gudgeon pin. Means for lifting the piston are provided in the crown. There are eight piston rings on the head and two scraper rings at the lower end of the piston skirt. The cylinders are lubricated by mechanically operated sight-feed lubricators which are fixed at top platform level at the left-hand end of the engine and also serve the exhaust valve spindle glands. The piston crown is slightly conical in shape, which conforms to the underside of the cylinder cover. There is, however, a central combustion space directly above the piston, at the top of which the spray valve is fixed. Both the air inlet valve and the exhaust valve are horizontal and the air inlet valve is housed in a separate casing which can be removed, so as to give access to the combustion space and the exhaust valve. As the drawing shows, a renewable exhaust valve seating is provided and the valve stem, which is a chrome-nickel steel forging, is supported by a bushed guide which is lubricated and is also removable. The atomiser or spray valve is designed to give a finely divided spray of fuel without the use of compressed air and is capable of spraying successfully a wide range of fuels. An injection pressure of over 2000 lb. per square inch is employed. Large cooling water spaces are formed in the cylinder cover and access to them is obtained for cleaning by removing the top cover plate. The arrangement of valves is such that vertical uptakes are obtained for both the air inlet and the exhaust valves. As will be seen from the illustration on the opposite page, a special heater is built on to the exhaust pipe at the front of the engine between the third and fourth cylinders for use with heavy residual oils. It consists essentially of a cast iron box with heating passages through which the hot gases pass. An adjustable flap valve permits of any desired temperature being maintained. The oil is filtered as it passes down to the fuel pumps, and a vent pipe is carried upwards to take any fumes. The air intake manifold runs at the back of the engine parallel to the exhaust main and on it two vertical air silencers are fixed, which are simple in design and effective in action.

Valve Gear Governor and Fuel Pumps.—All the valves are operated from a cam shaft which runs along the front



TYPICAL INDICATOR CARD

of the engine and carries separate air and exhaust cams. It is driven from the crank shaft by two spur gears with a 2 : 1 reduction and mitre wheels which drive an intermediate inclined shaft. The governor, which is easily accessible, is driven directly from the crank shaft by means of skew gearing and a vertical shaft, so that there can be no interference in the governor drive by cam action. The cam shaft is supported in large ring-oiled bearings and it also carries the fuel cams and the air starting cams which are arranged at the left-hand end of the engine. Our illustration above shows the general accessibility of the valve gear. The exhaust valves are operated by levers with cam rollers direct, while the air valves are worked by link-suspended rollers attached to push rods which pass between the cylinders to the valve levers.

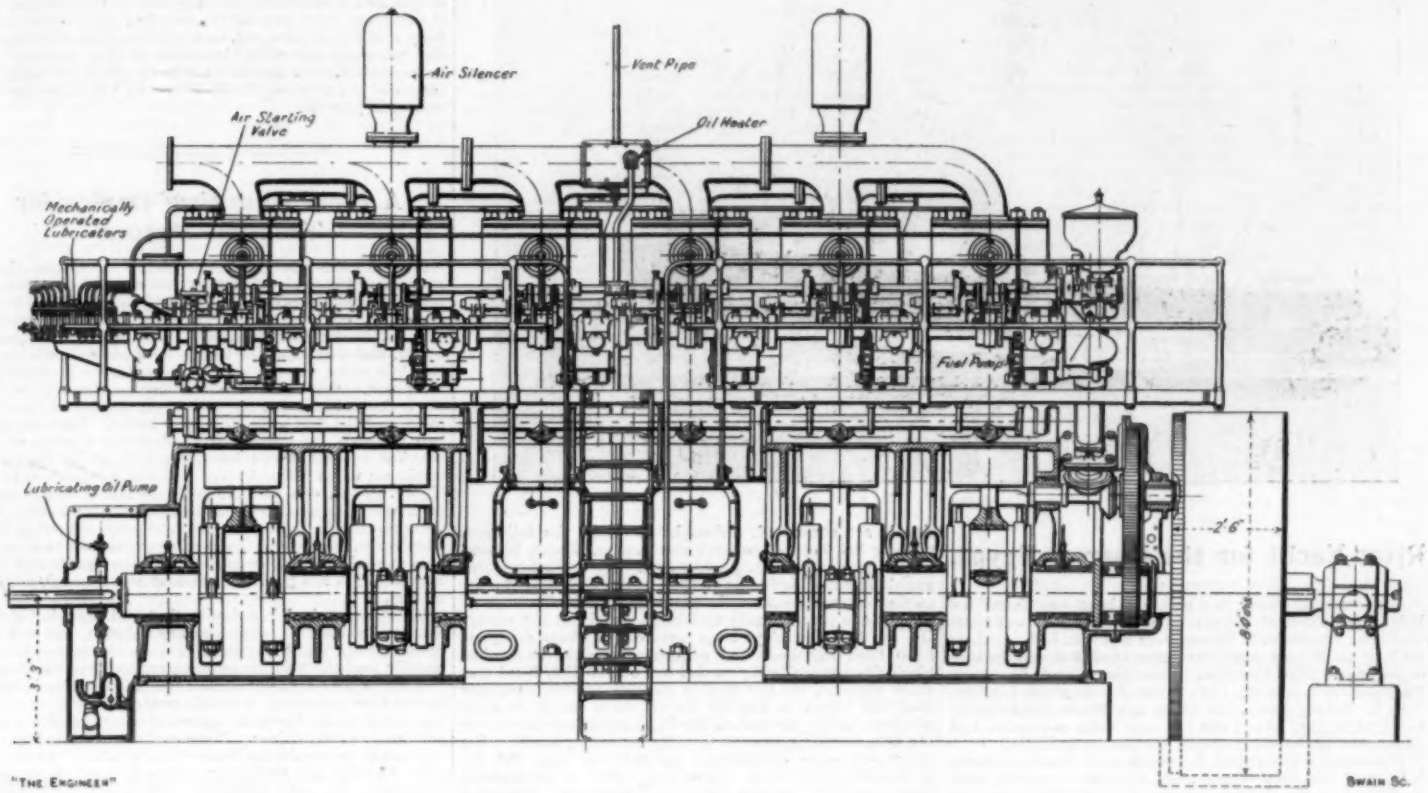
A vertical type of governor is employed, which works an oscillating shaft carried along the front of the engine above

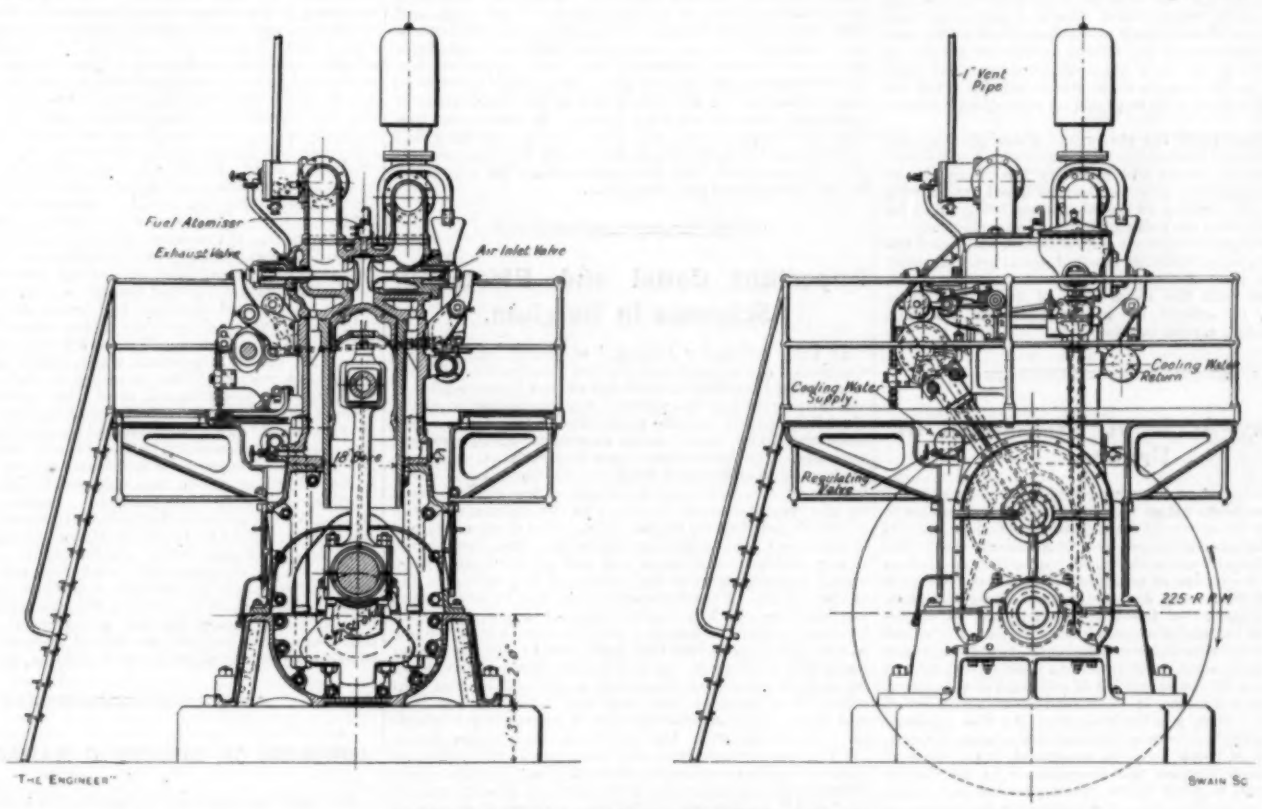
the cam shaft, which is supported on ball bearings. The general arrangement of the fuel pump controls is shown on page 156. A is the hand speed control lever, which is fitted at the governor end of the engine and allows the amount of fuel injected into the cylinders to be automatically reduced during the time the engine is being started up. After the engine gains speed the governor automatically takes charge of the fuel pumps. Separate fuel pumps are provided for each cylinder. From the governor shaft B a rod is carried down to the fulcrum roller C, which varies the stroke of the pump through an intermediate plate, one end of which is in contact with the cam. Independently of this link gear the roller of the fuel cam can be moved around its cam and the time of fuel injection so controlled. Each fuel pump may be primed and timed by hand by the levers D and E respectively. G is the fuel pump delivery valve with a connection to the fuel atomiser and F is the suction valve.

The engine is arranged so that the different cylinders fire in the following sequence :—Nos. 1, 4, 2, 6, 3, 5, and an air starting connection is fitted to cylinders Nos. 1, 2, and 3. There is a single starting air valve fitted with a vertical spindle and hand wheel, which will be seen near the left-hand end of the starting platform. The valve admits air from the starting receivers at a pressure of about 200 lb. per square inch to three distributing valves which are timed and mechanically operated by starting cams arranged on the main cam shaft.

Trial Results.—A series of bench trials were recently carried out at the maker's works on the first engine prior to its shipment. They included a six-hour full-load run at 610 B.H.P., three hours' run at three-quarter load, two hours at half load, and one hour at the maximum designed power of 675 B.H.P., the speed being 225 r.p.m. throughout the trials. The fuel employed was Asiatic fuel oil of ordinary quality with a calorific value of 18,000 B.Th.U. per pound and 0·95 specific gravity. The fuel consumption at full load was 0·44 lb. per B.H.P. hour, 0·46 lb. at three-quarter load, and 0·51 lb. at half load. With regard to lubricating oil, the trials showed that the total consumption was 3¼ pints per hour for the whole engine. On page 156 we reproduce a typical indicator card. The average mean effective pressure determined from a range of indicator cards taken at the working load was shown to be 82 lb. per square inch. As the engines are required for alternator driving a specially large fly-wheel has been provided to insure a very small cycle variation. In the governing tests the full load was thrown off the engine when it was running at a normal speed of 225 r.p.m; the speed momentarily rose to 235 r.p.m. and then became steady at 230 r.p.m. when the engine was running light. A test in the reverse direction in which the full load was suddenly applied gave a momentary speed of 220 r.p.m., after which the engine resumed a steady full load speed of 225 r.p.m.

The engines we have described are the largest of the vertical type which have been built by the Campbell Gas Engine Company, Ltd., for power station use.



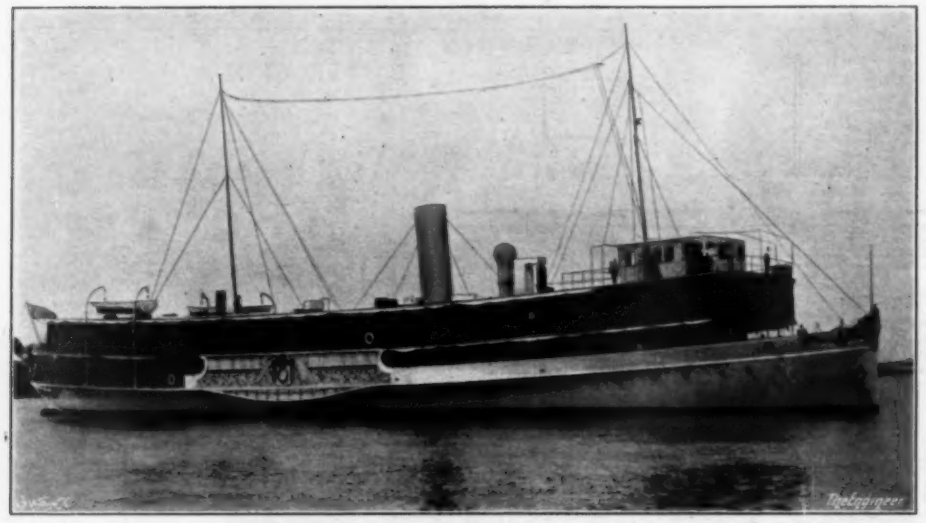


675 B.H.P. CAMPBELL AIRLESS INJECTION OIL ENGINE

In 1922 a board, consisting of the chief engineers of the Melbourne Tramway Board, the Victorian Railways, and State Electricity Commission, was formed to investigate the extent, nature and cause of the damage due to electrolysis. This board has now, according to the *Industrial Australian*, recommended the formation of a permanent electrolysis committee, which would consist of representatives of the Melbourne and Metropolitan Board of Works, the Tramways Board, the Postmaster-General's Department, the Victorian Railways, and the Metropolitan Gas Company, with a member of the Electricity Commission as chairman. Copies of the board's report have been forwarded to the various bodies interested, and a conference is to be called at an early date to discuss in detail this proposal of the board for the formation of a permanent electrolysis investigation committee.

RIVER YACHT FOR THE KING OF EGYPT

JOHN I. THORNYCROFT AND CO., LTD., SOUTHAMPTON, BUILDERS



River Yacht for the King of Egypt.

A HANDSOME vessel has recently been completed for H.M. King Fuad of Egypt. She was designed and built in England by John I. Thornycroft and Co., Ltd., at their Southampton yard under the inspection of the inspecting engineers to the Egyptian Government and Flannery, Baggallay and Johnson, Ltd., 9, Fenchurch-street, London, E.C. 3. Subsequently, the yacht was dismantled for shipment to Egypt, where she has now been re-erected and completed in the Government workshops at Cairo.

The vessel will be used by the King in touring on the Nile, and for that reason was specially designed with shallow draught and of suitable dimensions for passing through the locks below Cairo. She is a luxurious craft, constructed on modern and up-to-date lines with comfortable accommodation for a large number of guests. A feature of the yacht is a large observation room right forward on the promenade deck, which is fitted up in the form of a palm court with large sliding plate glass windows all round.

For the comfort of the passengers there has been installed a system of mechanical ventilation which is designed to renew, cool or warm and humidify the air in all the principal apartments. Electric lifts are fitted for carrying the officers and crew up to the navigating bridge, and for carrying food from the pantries to the dining saloons.

As will be observed from our illustration, the vessel has a smart appearance with her two tall masts carrying wireless aerials, teak deck-houses, and carved figurehead, paddle-boxes with the royal coat of arms, and stern decorations, all carved by native Egyptian workmen after the yacht's arrival in Egypt.

Railway Accident Prevention in France.

A YEARLY report upon railway accidents in France and upon the measures taken to prevent their recurrence is presented by Monsieur Maison, Director of the Contrôle de l'Exploitation Technique des Chemins de Fer. The report just issued deals with the accidents that took place in 1925. The number of accidents to trains in that year was 82, and there were 318 accidents at level crossings. The great majority of them were attributed to an inobservance of signals by engine-drivers, to excess of speed owing to a failure to observe the signals, and to mistakes in working the points. Six accidents were caused by rail breakages and by the spreading of rails and displacement of the permanent way. It is stated that this element of risk has since been greatly lessened. As the accidents were due mainly to drivers ignoring the signals, the railway companies were required to extend the system of automatic signalling on the locomotives to all danger signals and also to green lights. That work has since been proceeding so rapidly that the automatic repetition of danger signals on the locomotives will become general at an early date. On the Nord all the locomotives, numbering 2918, have been fitted with automatic signalling devices, except for the green lights, and arrangements are now being made to include these. On the Est system the whole of the 2186 locomotives have been equipped with automatic repetition signalling devices, although on certain lines the "crocodile" has yet to be installed. The "crocodile" is a conductor composed of copper strips about 13ft. long between the rails, over which passes a metallic brush on the locomotive, and when the electric circuit is completed by the closing of the road by the signal there is a characteristic blowing of the whistle. The name is derived from a fancied resemblance of the ramp, which guides the brush to the conductor, to the head of a crocodile. On the Orleans system the installation of the "crocodile" is complete and the 876 locomotives have been equipped, and arrangements are now being made for the automatic repetition of the caution signals. On the Midi system also the work is well advanced and 1096 locomotives have been equipped, leaving 204 still to be fitted with repetition signalling devices. On the State lines the whole of the 3139 locomotives have automatic apparatus, and the P.L.M. system is practically completed so far as the danger signals are concerned, although, as on all the railways, nothing has been done with the caution signals beyond preparing the necessary apparatus. As a further safeguard against accidents experiments continue to be carried out with automatic block systems in the hope of finding one that is really satisfactory and not too costly. On the State railways large numbers of electric signals have been installed, and experiments with mechanical block devices are being carried out on the Est, Nord and other systems, but the Midi is the only railway company that has begun to employ them. As a result of trials effected during the war on the Orleans railway the use of the despatching system is steadily increasing and is being employed more extensively on the Est and P.L.M., principally upon lines where the traffic is particularly heavy, such as between Paris and Vintimille. Following upon the succession of railway disasters a few years ago, when the extent of damage was aggravated by the collapse and burning of wooden coaches in collision, a tentative effort was made to supersede them with metal coaches, and the results are regarded as so far satisfactory that all express coaches in the future are to be constructed of metal and mounted on bogie frames. It is expected that this will diminish risks, and it is claimed that these and other precautions are responsible for the lessening number of accidents, which were less numerous and far less serious in 1926 than in the preceding year.

Important Canal and Electricity Schemes in Belgium.

IN the "Seven-day Journal" of March 11th last, we announced the appointment, by the Belgian Government, of a strong Commission to report on the improvement of the canal system of the country, the reorganisation of the electricity supply and the protection of the Meuse valley from the floods which cause enormous damage almost annually. The correctness of our forecast that, under the chairmanship of Monsieur Francqui, the Commission would lose no time in justifying its existence, was demonstrated by the presentation of its report to the Belgian Chamber by the Prime Minister on July 13th. The works envisaged in the report are of great magnitude, and, when completed, as one may fairly anticipate they will be, the result will be highly advantageous to the industrial and economic life of the country. The recommendations may be summarised as follows:—(1) The construction of a canal directly between Liége and Antwerp. (2) The construction of dams in the Ardennes to feed this canal and to irrigate certain parts of the Campine. (3) The improvement of the Meuse by straightening and deepening works and by the construction of three or four dams and locks between Huy and Visé. (4) The establishment of hydro-electric plants in conjunction with the Ardennes and Meuse dams. (5) The use of waste heat and waste gas in the industrial districts for the production of electricity. (6) The establishment of a general scheme of electrical interconnection or "grid" linking up all the large centres of electricity production and consumption in the country. (7) The construction of a number of super-stations at advantageous places to replace progressively the small and inefficient stations now in service, and to feed into the general network. (8) The carrying out of various special works on the Meuse, which, with the regulation made possible by the proposed dams, will eliminate, or at least greatly mitigate, the danger from floods. Until the subject has been debated in Parliament, it is too soon to discuss the details of the scheme, but it is likely that some works, such as the Liége–Antwerp Canal and the Meuse improvements will be carried out directly by the Government. It is possible that the dams and hydro-stations will be constructed and operated by private enterprise, with a reversion to the Government at the end of fifty years or so, a system which has been applied in Italy. As regards electricity supply, the object of the Government is apparently to bring about co-ordination by the formation of a vast national organisation, to be called the Belgian Electricity Union. The Commission has, indeed, drawn up a scheme for some such amalgamation of interests, and it is said that it has the approval of all parties concerned. It is estimated that the total cost of the works recommended by the Commission will amount to about two milliards of francs (£11,450,000), of which 300 millions of francs (or £1,714,000) will be spent annually during the first five years. The Prime Minister proposes to find the money from the "extraordinary receipts" of the Government, which are available for works of an urgent nature designed to increase the productive capacity of the country. With economy, these funds will suffice. In order to ensure the proper and continuous carrying out of the scheme, the Government is to propose the creation of an autonomous body of a public character, on which members representing the principal industrial interests of the country will preponderate. To this body will be given the administration of the necessary funds or credits which the Government will provide.

A Field Shunting Device for Traction Motors.

A DEVICE known as the "Auto-shunt" for automatically weakening the fields of motors driving various classes of road vehicles has been introduced by the Igranic Electric Company, of 149, Queen Victoria-street. On tramcar systems much time is wasted in consequence of congested traffic, and an endeavour has to be made to make up for this loss when the car gets an opportunity of making a clear run. On such occasions the acceleration of the car is dependent upon the current in the motor, the gear ratio, and the field strength of the motor. There are only two methods by which the accelerating current or the heaviest current drawn from the line can be kept at a minimum value without sacrificing the acceleration at the higher speeds, one method being to use a change-speed gear, which is almost impracticable on a tramcar. The other method is to vary the field strength, which has been adopted on tramways; but owing to the fact that in the past the driver could weaken the field irrespective of road conditions, it has proved inefficient and damaging to the motors.

What is required is a device that will provide for field shunting when the conditions are suitable, but will not permit of the field being shunted when the motors are too heavily loaded. The device must ensure that the shunt is put out of action when the load conditions change and the motor current reaches a certain predetermined value, and which will return the gear to the full parallel position independently of the driver. These and other advantages are claimed to be obtained with the "Auto-shunt," which consists of a relay and double-pole contactor with the requisite resistances for field shunting. The slight modifications necessary to the car controller can easily be made and consist in most cases of the addition of one finger and one small sector. Two types of this so-called "Auto-shunt" are at present available. In the case of type 1, which can be used in the majority of cases, provided the running conditions are suitable, field shunting takes place automatically at the full parallel position, whilst in the case of type 2, before shunting can take place, the driver must advance his controller to an additional notch. In this case an additional slight alteration to the controller is necessary, but in most instances this is not a difficult matter. A car that is fitted with the type 2 "Auto-shunt" giving one field shunting notch is started up and accelerated in the usual manner. If the driver desires to speed up as much as possible after the full parallel position has been reached he advances the controller to the full shunting position, but in the event of the load conditions being too severe to permit of safe field shunting, the device will prevent the field being weakened until the motor current drops to a predetermined safe value. The car will then automatically speed up, but if a gradient which makes it unsafe to run with a weakened field is met with, field shunting is automatically discontinued until the conditions again become safe. The system offers the additional advantage that it allows of an extra economical running notch without the objections associated with ordinary field shunting, and provides one or more additional speeds in the controller which, as a rule, has only two running notches—"full series" and "full parallel." Another advantage claimed for the device is that it leads to economy in cables and feeders. In order to obtain higher running speeds on cars high-speed gear ratios are frequently employed or motors with a comparatively weak field are used. But whilst achieving the desired end, both these methods, it is pointed out, produce in common with the usual method of field shunting heavy current peaks, which necessitate heavy cables and increase the risk of electrolytic damage to other cables and pipes in the vicinity of the track.

CONGRESS OF SCIENTIFIC MANAGEMENT.

THE third international Congress of Scientific Management is to take place in Rome from September 5th to 8th next. Former Congresses were held at Prague in 1924 and Brussels in 1925. The meetings will take place in the International Institute of Agriculture, which is situated in the grounds of the Villa Borghese.

Four classes of problems connected with scientific management will be discussed:—

(1) Industries and trade in industrial products.

(2) Agriculture and trade in soil products.

(3) Public services and public utilities.

(4) Domestic economics.

These subjects will be dealt with by four separate sections, and the resolutions arrived at will be submitted to a final meeting of the Congress as a whole. They will deal with such questions as maximum production, factory lay-outs, labour-saving devices, time studies and administration systems, for public authorities as well as manufacturing units.

Further particulars may be obtained on application to the organisers, E.N.I.O.S. (Ente Nazionale Italiano per l'Organizzazione Scientifica del Lavoro), Piazza Venezia, 11, Rome, or to the Production Department of the Federation of British Industries, 39, St. James's-street.

South African Engineering Notes.

Railway Employees.

The report of the Railways and Harbours Board for 1926 states that at the end of 1926 there were employed 53,720 Europeans, of whom 14,383 were labourers. Compared with the previous year the number of labourers had increased by 2245 and that of other Europeans by 648. In the year 1926 there were 40,878 non-European workers employed by the railways, or 3633 less than the year before. Altogether the railways employed 94,598 persons, or 689 less than in 1925. The increase in the number of Europeans is in conformity with the recognised civilised labour policy of the Government.

A Natural Carbon Dioxide Gasworks.

The first natural gasworks in South Africa has begun operations in Alfred County, 16 miles from Harding, Natal. The gas is regarded as the purest carbon dioxide gas, it having a percentage of over 98. In Alfred County, where the gas discharges have been discovered, a very wide area has been pegged, but the Natural Gas Company, which controls the major portion of the claims is the only company working. Since they are situated within 20 yards of the railway line they are in an admirable position. It is the intention of the company to cater for the South African mineral water trade and other directions in which such gas is needed.

Bridge for East London.

East London is likely at last to have a high level bridge constructed to connect the east and west banks of the Buffalo River. When, before Union, the west bank was developed for shipping a temporary wooden bridge with road and railway accommodation was put up, and it has remained the only bridge ever since. The town has urged the construction of a high level bridge, but the Government has hitherto contended that the town should contribute half the cost. Recently, however, it has offered to construct a permanent high level bridge at an estimated cost of £114,000, if the town would contribute one-third. A joint meeting of the City Council and the local Chamber of Commerce has approved of the proposal, subject to the contribution not exceeding £40,000, so it is probable the town's desires will now be realised.

Municipal and Other Enterprises.

The Umtata ratepayers have now authorised the Town Council to take all the necessary steps to carry out an electrical scheme and to raise a loan for the work. This scheme will provide for the harnessing of the Umtata Waterfall, and will make it possible for the Council to supply electricity for power purposes at as low a figure as ¼d. per unit, while the electric light tariff is expected to be 3d. per unit. The Municipality of Swellendam is about to call for tenders for the construction and installation of an electricity undertaking which, it is hoped, will be in commission by the middle of 1928. A new water-borne sewage scheme has been drawn up for the Municipality of Gwelo, which will cost approximately £27,500. The water supply of the town, taken solely from bore-holes, is expected to be sufficient for all purposes, including sewerage. The latter is estimated to require 10 gallons per head per day. The Rand Water Board is in the market with four large contracts. For the Vaal River scheme, piping to a total of 67,000ft. of 22in. and 24in. in diameter, with specials is wanted. A coal elevator and two chutes are to be erected at Zwartkopjes pumping station, which is also in need of a steam boiler. The Board is further calling for tenders for the supply of two centrifugal pumps and a travelling steam crane for the same station. Tenders are to be in by September.

Air Mail Service.

Major Miller, D.S.O., has completed his negotiations with the Government for an air mail subsidy, and is proceeding with his plans to start a service between Durban and Johannesburg early next year. The contract is for a period of five years, and provides for the payment by the Government of an annual subsidy of £8000 for the first two years. Thereafter it will be subject to review and reduction if the company is making more than 10 per cent. on the capital invested. The company will be South African, backed by British capital. The intention is to run a service each way three times a week, and if the demand increases, to make it a daily service. The single fare for passengers between Durban and Johannesburg will be £8 10s., and the schedule time for the trip will be 4½ hours. Besides mails and passengers the company will also carry light parcels. Ladysmith has been selected as halfway house, but passengers will be set down at any of the towns *en route*. The machines used on the long trips will be De Havilands of the latest commercial type. The choice rests between DH 50, a four-passenger machine, or the DH 61, which carries six passengers.

It appears, says the *Indian and Eastern Engineer*, extremely likely that the Irrawaddy will shortly be bridged at Sagaing. The main line runs from Rangoon to Myitkyina, about 342 miles, but there is a break where the Irrawaddy, just south of Mandalay, separates Sagaing on the north bank from Amarapura on the south. Here, therefore, follows a delay of over an hour to passenger traffic and inconvenience in goods transit, and the Burma Government is of opinion that a bridge at this point is one of the most urgent railway needs of the province. The Governments of India and Burma have agreed that the construction should be put in hand at the earliest possible moment. The estimated cost is 145 lakhs of rupees, of which the Burma Government proposes to pay 18½ lakhs of rupees as its first contribution, and from the date of the opening of the bridge a lakh of rupees each year for ten years.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Holidays and Afterwards.

Producers and consumers of iron and steel have this week paid little attention to business. Holidays have been generally extended throughout the whole of the Midlands to a full week, and industrialists have done their best to banish from their minds all thoughts of business and its attendant worries. At many of the works repairs have been carried out this week, and machinery overhauled, so that everything may be in readiness for the autumn demand as soon as it sets in. Producers are more eagerly awaiting this demand than usual, for the large arrears of work which gave such an impetus to productive activity during the early part of the year have now for the most part been overtaken and order books are becoming thin. During the past month or two the incoming business has been insufficient in itself to keep plants running, and had it not been for the remains of old orders, some of the works must have curtailed output. There would appear to be hopes of an added demand very soon now. Values are lower than they have been for several years, and once industrialists are convinced that there is nothing to be gained by further delay, business, which has been withheld pending lower prices, will be given out. A good deal of such work is known to be pending. Though general and heavy engineers find business patchy, and though their opinions formed at the beginning of the year of trade possibilities have not been realised, it is satisfactory to learn that in many instances the autumn outlook presents a fairly bright appearance. Several good contracts have recently come into the district which will find work to the end of the year for those fortunate establishments. That other equally good orders will be secured in the near future by local firms is a firm conviction.

Steel Prices.

Engineers in the Midlands and Staffordshire who sanguinely anticipated a reduction in steel prices as a result of last week's special meeting of steel masters were frankly disappointed when they learned that the Steel Manufacturers' Association, after considering the matter, had come to the conclusion that it was not desirable to make any change in sections and structural plate prices at the moment. Consumers had delayed placing orders in the hope of getting better terms than were possible before the holidays, but when work is resumed on Monday steel values will be precisely the same as they have been for some weeks past, even if some makers do not endeavour to get special prices for their output. At last week's meeting steel masters complained that present prices do not permit of profitable production, especially in so far as plates are concerned. They admit that steel prices have not fallen in the same proportion as iron since the coal strike ended, but they maintain that even before this steel values were at an unremunerative level. Engineers and other consumers of steel materials, for their part, claim that they cannot compete on the open market unless production costs are reduced, and with the rise in wages just granted to operative engineers the only place they can turn to for relief is in cost of materials. They are determined, they say, not to buy more steel at present prices than they can possibly help — enough to cover current requirements, and no more. They will not contract forward unless steelmasters meet them as regards prices. This is the position of things at the moment. Consumers claim they must have lower prices before they will buy and sellers are adamant in upholding present values. The small amount of business put through this week to enable works to restart on Monday was done at last week's rates, angles and joists remaining at the basis of £7 12s. 6d., and ship, bridge and tank plates at £8 7s. 6d. Billets, which are not subject to control, are priced at £6 10s. upwards, but they fail to make much headway against continental billets, which are roughly 20s. per ton lower. Small bars are stationary at £7 15s., as are Staffordshire hoops at £10 10s. at works. Makers of wire rods have recently reaffirmed the price of £9 5s. for rods rolled from English billets and £8 15s. for rods rolled from foreign material. Midland steelmasters hope that the action of the Siemens Steel Association in reducing tin-plate bars from £6 5s. to £5 15s. will have the desired effect of increasing the quantity sold against the continental product, although Welsh prices are still 15s. above those of their foreign rivals. Surely the superior quality of Welsh bars should compensate for the slightly higher price.

Steel Scrap.

The quietude of the steel trade has reduced the demand for scrap and accumulations of material are general both in merchants' and consumers' hands. Even at £3 2s. 6d. steel scrap is almost unsaleable.

Pig Iron.

There is no improvement in the pig iron department. Inquiry is almost non-existent, although users' stocks are low. Little hope of any reanimation before the autumn is held out. The limited output is sufficient for all current needs. Prices have not receded below those recently ruling, namely, £3 7s. 6d. for Derbyshire No. 3 foundry and £3 2s. 6d. for Northampton at furnaces. Forge qualities are in the neighbourhood of Derbyshire £3 4s., Northamptonshire £2 17s., but there is practically nothing being done in that grade of iron. North Staffordshire foundry iron is quoted £3 5s. to £3 6s. Middlesbrough iron is firm at £3 10s. There is hardly any continental iron coming into the Midlands, local irons now competing fairly effectively. Smelters buying coke on the open market find that prices have again turned against them, and it was difficult to-day to negotiate supplies below 14s. per ton at ovens. A week ago coke was available at quite 1s. per ton below this figure. Midland ironmasters continue to talk of "damping down" or "blowing out" furnaces, but so far no definite decision in this direction has been announced. Many of them, however, have considerable stocks, and it is improbable now that any great quantity of these will be absorbed as a result of the holiday period, few orders having been received during the vacation. Unless demand does improve it seems highly probable that further furnaces in this area will go out of commission.

Finished Iron.

The Staffordshire finished iron trade remains depressed. Most of the mills have had a full week's holiday. Makers of marked bars carried over some reserve of work, and this has been slightly added to during the week. Mills producing merchant bars are not so fortunately placed. They have few orders on hand, and at a number of the mills resumption of work will be delayed. Values stand unchanged. Marked bars are £13 10s., Crown quality £10 10s., nut and bolt bars £9 15s. upwards. Wrought iron gas tube strip sells at £11 17s. 6d. There is a tendency abroad to consider that finished iron prices are now down to rock bottom, and though there is no buying yet of iron on account of autumn requirements, the feeling prevails that September will witness a marked improvement in demand. It is sincerely to be hoped optimistic ironmasters will not be disillusioned, for they have had a lean time of late. Belgian competition in the common bar branch remains keen, a fairly large tonnage of bars bought at £6 per ton coming into the Black Country.

Galvanised Sheets.

Galvanised sheet prices have steadied themselves somewhat, as the £14 basis for 24 gauge corrugated sheets is maintained. Though the home demand is poor, a slight improvement is reported from some of the overseas markets, especially from Central and South America.

Ironworkers' Wages Reduced.

Wages of ironworkers in the Midlands which are regulated by the sliding scale under the Midland Iron and Steel Wages Board suffer another reduction as the result of the latest bi-monthly ascertainment. As from August 8th puddlers' remuneration is to be lowered by 5 per cent. the award being operative until October 1st.

Contracts for Midlands.

Holt and Willetts, Ltd., Cradley Heath, have, I learn, secured a contract for two 4-ton underhung jib cranes for the Mole, King's Dock, Swansea, given out by the Great Western Railway Company. Charles Willetts, Jun., Ltd., also of Cradley Heath, are to supply two 6-ton hand travelling cranes for the same company for the Cardiff Docks.

Canal Bridges.

The question of road transport and canal bridges, of which I wrote last week, has now been considered by the Warwickshire County Council, the view of which is that the incidence of the cost of bringing up the canal bridges to a standard sufficient to meet the requirements of present-day traffic should be a national charge. This view will undoubtedly receive careful attention at this week's meeting of Midland authorities who have the matter in hand.

LANCASHIRE.

(From our own Correspondents.)

Manchester.

The Engineering Outlook.

This week, as usual, several important engineering shops in the Manchester district are closed down for the annual holiday, and as we are now at the height of the holiday season, a perceptible slackening in industrial activity is noticeable. Probably not until early next month will conditions in this respect be more or less normal. The Manchester Chamber of Commerce *Monthly Record*, referring to the state of the engineering trade in the course of its general review, substantially confirms the situation as set out in this column a week ago. Heavy electrical firms, it is stated, continue to be well engaged, but the smaller firms are not in an equally good position. Constructional engineers have a good deal of work on hand, not only in this country, but in others, including the British Dominions. Textile engineers are not getting a great deal of work from the cotton trade, either at home or overseas, although the industry is not stagnant. Those who specialise in machinery for the manufacture of artificial silk have some big orders on hand. Motor manufacturers, too, are busy, and so also are cable makers. Other branches, however, are generally rather short of work—a fact which, it is pointed out, is attested by the continued dulness of machine tool making.

Non-ferrous Metals.

A rise of nearly £10 in cash tin since last report and the wiping-out of the backwardation in the case of forward metal are achievements in the non-ferrous metal market that are noteworthy even in respect of the tin section. The turnover in the metal, allowing for the holiday break, has been on a somewhat bigger scale than in recent weeks. Much of it, however, has been due to increased speculative interest. Little, if any, improvement, has occurred in the demand from home industrial consumers, although buying, both on continental and United States account, has shown some expansion. There is no doubt, however, that to a very large extent the rise is the result of the extremely "bullish" attitude of the market in relation to the statistical outlook. On the opening day after the Bank Holiday an advance of more than £6 a ton, compared with last week-end's closing quotation for prompt metal, was registered. Whatever the statistical position may prove to be—the month-end figures of "visible supplies" are not available at the time of writing—it is obvious that any improvement in strength has

already been largely discounted for the time benig. Copper, also, has experienced an improvement, although on a much more modest scale. Domestic buyers have been operating a little more freely, sales to the consuming industries, more especially to the cable-making branch, having expanded slightly, and the market has continued the recovery which set in about a month ago. Both lead and spelter are stronger on the week, although in each case it is probably more in sympathy with the other sections than because of any fundamental improvement in the position of these metals.

Iron.

So far as current business, either in pig iron or manufactured iron is concerned, there has been very little worth mentioning this week, although with makers in the former case apparently ready to take a less despondent view of things, the outlook to that extent seems rather more hopeful. This attitude is due to the fact that bookings during the last few weeks, although still rather small individually, have amounted to a fair aggregate tonnage, and there is a feeling among part of the selling section that there will be a further spurt in buying with the approach of the autumn. In the meantime, the demand is slow, and probably will remain so for the rest of this week. Scottish brands of foundry iron offered on this market have further weakened slightly, and at their present level of about 94s. per ton, delivered Manchester or equal, quotations are exactly where they were before the coal stoppage of last year, and may now be taken as at rock bottom. Other varieties have remained steady all round, Derbyshire makers quoting for delivery here at 75s. 6d. to 76s., Staffordshire at 76s., and Middlesbrough at 83s. 2d. Hematite iron, both East and West Coast brands, is offered for Manchester delivery at from 89s. to 90s. per ton. With, as a rule, not more than half their productive capacity covered by the current demand, Lancashire makers of bar iron seem to have good reason for continued disappointment at the state of business. Crown bars are quoted at £11 and seconds at £10 per ton.

Steel.

With steel buying largely confined to hand-to-mouth transactions, and not many of these during the present week, conditions in this branch of trade are dull. Old contracts are, of course, fast running out, but in anticipation of more favourable prices later on, users generally are doing little more than covering early needs, a policy which, in view of the fact that favourable delivery is easy to secure, is by no means difficult to carry out. No change in the price position can be reported, sections being quoted at £7 12s. 6d., ship plates at £8 7s. 6d., boiler plates at £11 5s. to £11 10s., and sheet bars at £7 17s. 6d. to £8 10s. Less weakness is in evidence in the case of galvanised sheets, but both inquiry and demand are inactive; 24-gauge materials are being offered at £14 per ton, f.o.b. In view of the absence of any serious buying in the market for continental steel products, values are more or less nominal at £7 10s. for Siemens plates, for net cash against shipping documents and including delivery to users' works in Lancashire, £7 3s. 6d. to £7 5s. for Thomas plates, £5 15s. for steel bars, £5 6s. to £5 7s. for sheet bars, and about £5 2s. 6d. per ton for billets.

BARROW-IN-FURNESS.

Hematites.

The position in the hematite pig iron trade is indicated by the fact that the Barrow Hematite Steel Company has temporarily damped its two big furnaces, because its steel plant has closed down for the week for the holidays. There is not much outlet for iron on the open market. At Millom the men at the furnaces have been put on day-to-day engagements, while one furnace has been put out, leaving two in operation. Business is almost at a standstill. It is reported that some buyers are still holding out for further cuts in prices, but no concessions have been made beyond the recent reduction.

Iron Ore.

The demand for iron ore is easier on local account and little foreign ore is coming in.

Steel.

In the steel trade the plants at Barrow and Workington are idle on account of the holidays this week. The general demand for steel is very quiet, particularly as to the chief product, steel rails. Hoops are a fairly good business at Barrow. Castings are in fair demand.

Shipbuilding and Engineering.

In these trades the holidays are being observed, There is a fair programme of work in hand. One of the two submarines built at Barrow for the Australian Navy has left for Chatham.

Fuel.

For both coal and coke the demand is quiet.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Conditions.

THERE is no improvement to report in the state of various branches of the steel industry; in fact, many firms report a falling off of work during the past week. This condition of things is no doubt due to the holidays, but it seems to be on a larger scale than in previous years. No revival of a substantial character is expected before September, and, while there is a fair amount of confidence in the future, some anxiety is also felt. The holidays at the works were of normal duration, with one or two exceptions. Vickers Ltd. is among the firms most fortunately placed at present. It is so busy that overtime is being worked at both its River Don and Attercliffe Common works, and the holiday break was restricted to Monday only. At the works of the United Steel Companies, Ltd., twelve out of the twenty-four open-hearth furnaces are in operation.

Russian Obligations Fulfilled.

In the lighter and finished branches of trade, July proved the quietest month of this year. This condition had a marked effect on the rolling mills, which are very slack at present. The depression is no doubt partly due to the holiday season, but at the same time concern is being felt at a drop in the exports of tools to the Dominions. A good deal of the idleness in the file and tool-making branches is due to the absence of orders from Russia. Fears of a repudiation of Russian debts, following upon the recent rupture of diplomatic relations, have happily proved groundless. The long-credit terms on which most of the orders were taken had not expired when the trouble arose, but since then all the instalments have been paid punctually, and Arcos, Ltd., has so far fulfilled all its local financial commitments. Sheffield manufacturers are still hopeful of a resumption of trade with Russia in the New Year. It is understood that the British Government will not do anything which would be likely to interfere with such a development.

Points About Prices.

The buying of raw material on a forward basis is being deferred until after the holidays. It is believed that prices of both raw and semi-manufactured materials have now touched bottom, however, and that consumers have little to gain by continuing their hand-to-mouth policy. In blast-furnace coke, in fact, the downward movement has been stopped. A good deal of surplus coke has been sold for export, and the quotation for best brands has risen from 12s. 6d. to 14s. per ton at the ovens. Recently there has been a continuous decline in the prices of tungsten, owing to cheaper ore, restricted demand, and severe competition for the limited business which is to be obtained. Tungsten metal powder is selling at 1s. 8d. per lb., while in ferro-tungsten there have been transactions below the quotation of 1s. 4d. per lb., which is said to be the lowest since the war.

Advertising Sheffield Goods.

The importance of advertising Sheffield's lighter products by means of show-cases to be placed on view at industrial exhibitions in the Colonies has been under the consideration of the Chamber of Commerce, the Council of which has sanctioned a proposed scheme. The secretary of the Chamber points out that at present there are twenty-five industrial exhibitions being held in various parts of Canada, twenty in South Africa, nine in Australia, and three in New Zealand, and it may be presumed that there are very few, if any, Sheffield products exhibited. Buyers in the Colonies are utilising these exhibitions to a great extent, and there is little doubt that if by some means Sheffield goods could be shown, definite orders would result. The idea of the scheme is that show-cases will be fitted with articles showing the processes of manufacture, and examples of various Sheffield commodities, such as cutlery, small tools, drills, milling cutters, &c. The articles will not bear the name of any manufacturer, but will have an indication of their Sheffield origin, and each case will be accompanied by a large number of printed pamphlets containing the names and addresses of all the Sheffield manufacturers. It is intended that the Senior Trade Commissioner shall take steps to ensure that the cases are on view at every important exhibition, while, when no exhibitions are taking place, they could be sent to schools and colleges.

Big Orders for Wafer Blades.

Although an order has been made for the winding-up of Darwins, Ltd., the great Sheffield firm of safety razor blade manufacturers, Mr. P. R. Kuehnrich, the managing director, is optimistic as to the future. He has recently returned from a month's visit to America, and reports that he is more than ever convinced of the future of the razor blade industry in that country. He has secured contracts there for the enormous quantity of 120,000,000 blades per annum, and he is going back in October to make arrangements for their distribution. The firm's Fitzwilliam Works are at present being carried on by an official liquidator. Mr. Kuehnrich says he is very hopeful that before the summer is out he will be able to make new financial arrangements so that the works can be kept going at full swing.

New Ganister Mine.

A new ganister and coal mine at Wharncliffe Crags, within a few miles of Sheffield, has just been opened up by Messrs. J. Grayson Lowood and Co., manufacturers of silica bricks, of Sheffield and Deepcar. The mine is in a district famous for its ganister, and its present yield is of a most encouraging character. Underneath a seam of coal, 20in. thick, is a rich seam of what is known as Halifax hard-bed ganister, which is the accepted standard of best Sheffield ganister. At present the seam averages from 2ft. 6in. to 3ft. in thickness, but it is anticipated that it may reach 5ft. when further developments have taken place. It is expected that when the mine is fully opened out it will be the largest in this district, and that the average thickness of the seam will be considerably greater than anywhere else in the Don Valley or possibly in Yorkshire.

The Consumption of Smoke.

The question of smoke abatement is ever present in Sheffield, and especially so now that a Committee has been established under the Smoke Abatement Act of last year. At their first meeting the members of the Committee—which represents Rotherham as well as Sheffield—visited the Nunnery Colliery to witness a demonstration of the Eureka smoke consumer, which has been fitted to three boilers there, and which is to be installed on the boilers at the company's other pits. The Dewhurst Engineering Company, of Sheffield, has the manufacturing rights for the United Kingdom. The invention consists of uptake pipes with air inlets placed at the rear of the coal-fired boiler, the dampers of which are shut down to prevent smoke reaching the chimney stack. By means of a motor and fan, this smoke is drawn from the space behind the boiler and sent through conduits over the top of the adjoining boilers and underneath the fire-bars. In these boilers coke breeze is used as fuel, and a high enough temperature is maintained to cremate the smoke from the other boiler, and thus only invisible vapour emerges from the chimney stack. It is claimed that the boilers used as consumers maintain a greater efficiency in steam power than when fired with coal, and thus not only is the smoke nuisance abolished but a greater efficiency is maintained on a low-grade of fuel. The work being all of an external character, the boilers are not put out of action and no delay arises by the invention being fitted to any existing installation.

Railway Autocar Trials.

The London and North-Eastern Railway Company last week held successful trials of the Clayton steam autocar on its line between York and Whitby, over the Scarborough coast line, and also on the Newcastle and Ponteland branch. The car, which weighs 25 tons, is carried on two four-wheel bogies. It provides seating accommodation for sixty passengers. The engine is furnished with a vertical boiler, and has a pressure of 275 lb. The coal consumption is only about 10 lb. per car mile. The fuel is carried in a tender in front of the carriage.

NORTH OF ENGLAND.

(From our own Correspondent.)

Coal Yield Lowest Yet Recorded.

FROM the economic point of view, the coal-mining industry of Northumberland and Durham has now reached an acute stage. Each month the colliery owners have to make up a large deficiency as between proceeds and costs. Under the county agreements made after the termination of the national coal stoppage last year, owners pay wages to the miners on percentage basis rates which the low price realised for the coal cannot meet. Prices have fallen ever since the men resumed work, until now the joint reports of the accountants indicate the lowest economic yields yet recorded. For Northumberland, the report of the accountants of the proceeds and costs in June, which, but for the minimum clause in the county agreement would regulate wages in August, shows that the percentage on the basis rates would be only 23 per cent. The county minimum is 80 per cent., and thus the deficiency to be made up by the owners is 57 per cent. In July the percentage was 34·37, and therefore the decrease on that month was 11·37 per cent. After the first ascertainment in March the percentage on the basis stood at 79·64. Northumberland is chiefly an exporting county, but many of its former markets were lost during the national coal disputes of 1921 and 1926, and they have only been partially recovered, and then at the foreigner's price, for he has great sources of supply open to him at competitive prices outside England. In Durham county the ascertainment indicates that but for a minimum of 89 per cent. on basis rates, wages would be only 38·35 per cent. thus leaving the owners to make up 50·65 per cent. In July the percentage on basis rates stood at 54·01 per cent. and therefore the drop in the month is 15·66 per cent. In March the percentage on basis rates was 69·31 per cent.

Cleveland Iron Trade.

The position in the Cleveland pig iron trade is very disappointing. The market continues to be chiefly nominal, with orders difficult to secure. At the same time hope is entertained that autumn requirements will necessitate a fair amount of buying. Consumers have been holding off the market so long that their stocks must be low, and this inspires belief that business must be accumulating. A few home and export inquiries are circulating, but to some of the latter are attached conditions which appear to prohibit actual transactions. Buyers continue to press for lower quotations, but producers protest that, with current rates yielding little or no profit, and in some cases incurring actual loss, further price concessions cannot be granted. The prevailing opinion is that, when purchases are compelled to come forward and negotiate for fall-of-year requirements, they will pursue a very cautious policy and confine their operations largely to buying small parcels for early delivery. Output of pig iron continues to exceed demand, and there is probability of the already restricted production being further curtailed in the near future. Stocks are steadily increasing, and the accumulations of iron at some of the works are assuming considerable proportions. Belgian iron has been bought on Tees-side at 4s. and 5s. per ton below Cleveland price levels. A slight advance in continental prices last week, however, narrows the gap, and may be regarded as a distinctly hopeful sign, the more so because doubts exist as to whether or not foreign manufacturers can afford to maintain indefinitely the present rates. No. 1 Cleveland foundry iron is 72s. 6d.; No. 3 G.M.B., 70s.; No. 4 foundry, 69s.; and No. 4 forge, 68s. 6d.

Hematite Pig Iron.

A very quiet tone also prevails in the East Coast hematite pig iron trade. Burdened with large stocks, producers are keen to sell, and readily give favourable consideration to offers below the recognised market rates, which are based on 75s. 6d. per ton for mixed numbers.

Ironmaking Materials.

Imports of foreign ore last month totalled 137,000 tons, but new business is almost at a standstill. Sellers still name 21s. 6d. per ton c.i.f. Tees as the price for best Rubio ore. Durham blast-furnace coke makers are endeavouring to check the downward trend of values, but consumers are markedly disinclined as ever to pay prices named. Good average qualities are put at 19s. per ton delivered at the works.

Manufactured Iron and Steel.

Producers of finished iron and steel are still actively employed on old contracts that keep tonnage output heavy, but much of the work in hand is rapidly approaching completion, and continued dearth of new business is causing anxiety. Manufacturers, however, refuse to quote lower rates than those which have ruled of late.

The Coal Trade.

The feeling among colliery fitters and merchants is more cheerful in regard to the coal trade than it has been for some time past. There is no special business to brighten up the situation, but the tone is much better, and the quickened prompt demand has given prices of certain qualities of fuel a fillip to the extent of about 3d. per ton. It does not seem very much, but it is welcome, if only the trade will go on expanding. August supplies have been heavily booked up, and for the moderate surplus likely to be available, holders can afford to be independent for the early part of the month. For later deliveries and also over the year, business is being negotiated at advanced prices. The Durham gas coal trade is a special feature. Business over the year is stated to have been effected at 16s., this being an advance of 3d. per ton on the previous sales, but it is now difficult to secure this class of coal, except at an advance on 16s. Secondary grades are also firmer, and several qualities recently offering round about 13s. 6d. are now held at 14s. as minimum. Steam coals are a good and steady market. Best Blyth steams have been done over the year at 14s. 3d. Second qualities are very steady, and smalls are meeting with just a shade better inquiry. There is just a quiet business for coking unscreened at about 14s. for good descriptions. Bunkers are fairly active and steady. The pressure for gas coke is maintained, and under substantial forward inquiries, prices are firm at 20s. 6d. for best qualities. Patent foundry cokes are quiet but steady. good ordinary being 18s. 6d. to 20s.; special makes, 24s. to 26s.; beehive, 28s. to 32s.

Iron and Steel Exports.

Exports of pig iron, manufactured iron and steel from the Cleveland district during July showed a marked improvement, the total of 102,096 tons being the best recorded since April last, when 106,323 tons were shipped. In June only 85,663 tons were exported. The pig iron shipments totalled 11,824 tons, of which 4061 tons went abroad, as compared with a total of 11,843 tons in June. The manufactured iron and steel exports reached 90,272 tons, as compared with 72,500 tons in June. India was again the largest customer for steel, with 20,876 tons, while 12,955 tons went to the Argentine, and 11,540 tons to Australia.

More Work for Tyne.

Armstrong, Whitworth and Co., Ltd., have received the order for three pairs of steel dock gates complete with hydraulic operating machinery for the new 110ft. entrance lock at Tilbury. These gates, which are the second largest in Great Britain, will be constructed at the Armstrong Naval Yard, and the operating machinery will be built at the Elswick Works, engine works department.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

THE output from Clyde shipyards during the month of July was some 20,000 tons below the figures for the preceding month. This drop may be partially explained by the intervention of the annual holidays. The output for this year to date is considerably below the average for the period. During the month of July twenty vessels of 20,309 tons aggregate were launched, this being the lowest total since February last. The figures for this year are 129 vessels of 165,480 tons aggregate, which compares with 92 vessels of 171,449 tons in the same period last year, when production was almost suspended for a time owing to the coal situation. Apart from the year 1923 one has to go back to the 1908–9 period to find a total in the region of 175,000 tons for the seven months' output. A fair number of contracts have been placed this year, but the rate of production continues slow. The vessels launched during last month were mostly small craft, including dredgers, tugs, motor yachts, passenger and cargo steamers, and cargo boats. Only three of the number were over 3000 tons, and these are as follows:—Alfonso, passenger and cargo, 3100 tons, for the Sociedad Anonima Ganadera y Commercial Menendez-Behety, Punta Arenas; Jalabala, 3600 tons, cargo, for the Scindia Steam Navigation Company, Ltd., Bombay; and the Venetia, an oil tanker of 5500 tons, for Messrs. Gow, Harrison and Co., Glasgow. Contracts announced during July were few in number, and the only item of note was one for two cargo steamers of 9100 tons deadweight carrying capacity for Messrs. T. and J. Harrison, of Liverpool.

Steel and Iron.

Owing to the state of trade the steel and iron works have been closed for a longer period than usual this year. During the past week business proceeded on a most modest scale, neither producers nor consumers showing much interest in the markets. It is said that sufficient specifications have accumulated to ensure a fair restart; but that the outlook is still far from promising. No change in prices has been reported, but considerable speculation is rife as to a possible reduction of some controlled prices in the near future. Nothing much in the way of continental material has come in during the past two or three weeks.

Imports and Exports.

Since the end of June 53,000 tons of iron ore have been discharged at Glasgow Harbour, also 2900 tons of pig iron from St. Nazaire, 500 tons pig iron from Calcutta, and 1200 tons of iron from the Continent. Shipments of iron amounted to 13,000 tons, the bulk of which went to Australia, New Zealand, South Africa, South America, Japan, India, and New York.

Pig Iron.

The pig iron market has developed further weakness and current quotations are now as follows:—Hematite, 80s. 6d.; No. 1 foundry, 82s. 6d.; and No. 3 foundry, 77s. 6d., all per ton for home delivery.

Coal Market Idle.

The coal market has hardly recovered from the holiday influence, and business has been extremely quiet. Best Lanarkshire splints still provide the only firm feature in round coal, though second splints are now somewhat better off and steady. Washed materials in the West of Scotland have eased a trifle, but maintain a very firm level in Fifeshire and the Lothians, and especially in Fifeshire. Collieries have been endeavouring to induce buyers of industrial smalls to take a proportion of round fuel, but their efforts in that direction have met with scant success. Aggregate shipments during the week amounted to 189,650 tons, against 124,873 in the preceding week and 120,880 tons in the same week in 1925.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Position.

THE conditions during the past week have been entirely under the influence of holidays, and it will be next week before the position becomes settled. Business is naturally very quiet, and it is likely to remain so during the current month and possibly the first half of September. A certain amount of business has, of course, been done for shipment up to the end of the year, and there are other buyers of monthly cargoes up to March next. The volume of operations for early loading is comparatively restricted and there is no sign of an immediate expansion. Shipments last week were slightly better than during the previous week, as might be expected from the fact that both exporters and shipowners were anxious to get cargoes away before the holidays. The total quantity of coal exported came to 450,428 tons, which, compared with 433,522 tons for the previous week, but even this higher figure is quite inadequate for this market, as it is much below production, especially seeing that home consumption is well below the normal. Unless tonnage comes along very freely this week it is probable that collieries will have a very lean time. There was such a marked exodus of tonnage last week that on Saturday no less than fifty-three idle loading berths were reported at the various docks in this district. Coals, of course, will not be quite so plentiful this week on account of the three days' holidays in the coalfield, and in all probability business will be on a more restricted scale throughout the whole of August. Nevertheless, the supply will be quite, if not more, than ample for market requirements. As regards contracts which have been entered into, news has been received that the Navagazione Generale Italiana has purchased between 70,000 and 80,000 tons of best Admiralty large coals for delivery up to the end of the year, and the Norte Railways of Spain have bought about 19,000 tons of Admiralty large coals, while two cargoes of large of about 5000 tons each for shipment to Haifa for account of the Palestine Railways have been placed.

Coalfield Items.

There has again been a failure to reach agreement between the representatives of the craftsmen and the coalowners of this district with regard to the decision of the independent chairman respecting the payment of the subsistence wage for overtime shifts. The Executive Committee of the Craftsmen's Association discussed the matter at a meeting on Thursday last week, when the definite decision was arrived at that the coalowners' interpretation was unacceptable to the workmen, but there is to be a further conference between the parties on the 9th inst. A special delegate meeting of the South Wales anthracite miners at Swansea on Saturday decided to call for a conference of the whole of the South Wales coalfield as soon as possible in order to consider the action to be taken regarding the question of overtime. The position which has arisen from the award of the independent chairman regarding the subsistence wage and its application to overtime will also be discussed at this conference. With reference to the irregular working of collieries, the district officials were instructed to invite representatives of the Amalgamated Collieries, Ltd., to meet them with a view to arranging for the sharing of the work available among the respective collieries. It was pointed out that some pits worked regularly while others were more often than not at a standstill.

Docks Depression.

The restriction of work in the coalfield which has been brought about by the depression in trade has been very much felt at all the ports in this district. The Great Western Railway Company has recently given notices to terminate employment to twenty coal tippers at Penarth, which is one-fourth of the total number of this class of workman at these docks. This action on the part of the company has caused considerable anxiety to employees, and there was a specially convened meeting between the men's representatives and officials of the company last Friday to discuss the position. The men's leaders put forward the suggestion that Penarth should share the work available with the other docks which are more favourably situated, but that, of course, is a matter over which the company has no control. The decision as to where ships shall proceed to load does not rest with the G.W.R. Company, but with the shipowners and charterers. Mr. Ben Carpenter (assistant docks manager) pointed out that the company would give every consideration to the appeal of the workmen's representatives that Penarth tippers with long service should have preferential treatment over men who had been engaged in recent years at adjacent ports.

Firms Link Up.

It is reported that an agreement has been arrived at under which Gueret, Llewellyn and Merrett, Ltd., of Cardiff, acquires a controlling interest in the firm of A. J. Pope and Co., of Cardiff, which firm is interested chiefly in the export of coals to Spanish ports. The latter firm will continue to trade under its own name with Mr. Pope as managing director.

Retirement of Mr. Chamen.

The announcement is made that Mr. W. A. Chamen, who was appointed engineer and general manager of the South Wales Electrical Power Distribution Company in December, 1905, will retire from that position about the end of this year. He will be offered a seat on the board of that company and also one on the board of the South Wales Power Company, Ltd.

Current Business.

Operations on the coal market have been practically at a standstill during the past week owing to the holidays. In the circumstances prices are simply nominal and are likely to remain so until business conditons become more settled next week.

CONTRACTS.

JOHN THOMPSON WATER TUBE BOILERS, Ltd., Imperial House, Kingsway, London, W.C. 2, has received an order from the Metropolitan Asylums Board for one of its horizontal tube staggered header "Zeta" type water-tube boilers, complete with chain grate stokers, feed pumps, condensate tank, brickwork, pipework, &c., for the Darenth Training Colony (Adults' Section), Dartford, Kent.

ARMSTRONG, WHITWORTH AND CO., Ltd., have received from the Port of London Authority the order for three pairs of steel dock gates complete with hydraulic operating machinery for the new 110ft. entrance lock at Tilbury. These gates, which are to be the second largest in Great Britain, being second in size only to those at the Gladstone Dock, Liverpool—also supplied by the firm—will be constructed at the Armstrong Naval Yard, the hydraulic operating machinery being manufactured at Elswick Works, while the erection of gates and machinery at site will be carried out by the firm's engine works erection department.

WORTHINGTON-SIMPSON, Ltd., of Newark-on-Trent, and Queen's House, Kingsway, London W.C. 2, has recently received from Armstrong, Whitworth and Co., Ltd., an order for the following pumps for installation on each of the two vessels which that firm is building for Tankers, Ltd. The pumps for each of these vessels consist of the following:—Two horizontal duplex stream-line cargo oil pumps, each of 300 tons capacity; one horizontal duplex stream-line drain oil pump, and one each of the following, all of them of the vertical type:—Simplex ballast pump, duplex oil fuel transfer pump, simplex general service pump, simplex auxiliary feed pump, simplex oil fuel transfer pump, duplex ballast pump, simplex fresh water pump; one surface type feed-water heater, and one combined evaporator and distiller pump.

CATALOGUES.

BRITISH INSULATED CABLES, Ltd., Prescot.—Booklet on the "Prescot" wiring system.

ASHWELL AND NESBIT, Ltd., Barkby-lane, Leicester.—Brochure dealing in detail with pneumatic conveying plants.

ROBERT MACLAREN, 107, Canal-street, Glasgow, C. 5.—Pamphlets on "MacLaren's" patent electric and gas temperature controls.

DANIEL ADAMSON AND CO., Ltd., Dukinfield.—A series of twelve sketches of the firm's improved automatic sewage lifting equipment.

SIMONIS, Ltd., Willesden-lane, N.W. 10.—A leaflet describing a patented continuous foam generator using a single powder for fire-fighting.

BROOKHURST SWITCHGEAR, Ltd., Northgate Works, Chester.—Booklet No. 221, describing some installations of the Brookhurst marine type control gear.

MAIN ROPEWAYS, Ltd., Australia House, Strand, W.C. 2.—Latest catalogue illustrating and describing a number of aerial ropeways erected by the firm.

TANGYES Ltd., Cornwall Works, Birmingham.—Catalogue dealing with the "W" type fuel oil engine with variable admission governing, of both the lamp-starting and cold-starting types.

THE GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, W.C. 2.—Pamphlet describing the "Magnet" mechanical refrigerating machine applied to commercial installations.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., Kinnaird House, Pall Mall, S.W. 1.—Brochure No. 385, giving illustrations of the hydraulically operated presses and machinery the firm manufacture.

SIEMENS BROTHERS AND CO., Ltd., Woolwich, S.E. 18.—Leaflet 2050 giving particulars of electrical pyrometers and thermometers; and pamphlet 840A dealing with electrical distance thermometers.

CROMPTON AND CO., Ltd., Chelmsford, Essex.—List 82 on "Mining Electrical Plant"; list 83 on "Electrical Plant in Paper Mills"; list 84 on "Dock Electrical Plant"; and list 85 on "Marine Electrical Plant."

THE INSPECTION OF MINES IN BELGIUM.—After many years of agitation on the part of the labour organisations, the Belgian Parliament has just yielded to the demand that mining inspectors should be appointed from the ranks of the trade union workmen. The procedure is to be that for every vacancy the Minister of Labour shall appoint one acting and one reserve inspector from four candidates nominated by the union, and only in case of the candidates being "insufficient," shall he make any outside appointment. The appointments will be made for four years. The employers made no objection in principle to the employment of workmen inspectors, but maintained that there should be no discrimination between unionists and non-unionists.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	18/6 to 21/–
(1) Spanish	18/6 to 21/–
(1) N. African	18/6 to 21/–
N.E. Coast—	
Native	18/– to 21/–
Foreign (c.i.f.)	21/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	3 19 0 to 4 0 0	
No. 1 Foundry	4 0 0 to 4 2 6	
No. 3 Foundry	3 17 6	—
N.E. Coast—		
Hematite Mixed Nos.	3 16 0	3 16 0
No. 1	3 16 6	3 16 6
Cleveland—		
No. 1	3 12 6	3 12 6
Silicious Iron	3 12 6	3 12 6
No. 3 G.M.B.	3 10 0	3 10 0
No. 4 Foundry	3 9 0	3 9 0
No. 4 Forge	3 8 6	3 8 6
Mottled	3 8 0	3 8 0
White	3 8 0	3 8 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
„ „ Foundry	3 5 0 to 3 6 0	
(3) Northampton—		
Foundry No. 3	3 2 6	—
Forge	2 17 0	—
(3) Derbyshire—		
No. 3 Foundry	3 7 6	—
Forge	3 4 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 6 6	—
No. 4 Forge	3 5 0	—
Basic	3 7 6	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 9 6 (a) / 4 12 6 (b) / 4 16 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 15 0	10 10 0
Best	—	
N.E. Coast—		
Iron Rivets	12 5 0	—
Common Bars	11 5 0	—
Best Bars	12 5 0	—
Lancs.—		
Crown Bars	11 0 0	—
Second Quality Bars	10 0 0	—
Hoops	14 0 0	—
S. Yorks.—		
Crown Bars	11 10 0	—
Best Bars	12 5 0	—
Hoops	14 0 0	—
Midlands—		
Crown Bars	10 10 0 to 10 15 0	
Marked Bars (Staffs.)	13 10 0	—
Nut and Bolt Bars	9 15 0 to 10 0 0	
Gas Tube Strip	11 17 6 to 12 0 0	

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	11 0 0	11 0 0
Ship Plates, ¼in. and up	8 2 6	7 12 6
Sections	7 12 6 to 7 15 0	7 2 6
Steel Sheets, under 3/16in. to ¼in.	10 0 0 to 12 0 0	
Sheets (Gal. Cor. 24 B.G.)	—	£14 0 0 to 15 0 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 2 6	—
Angles	7 12 6	—
Boiler Plates	12 10 0	—
Joists	7 12 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 12 6	—
Soft Billets	7 12 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	
Billets	7 10 0 to 10 10 0	
Manchester—		
Bars (Round)	8 12 6	—
„ (Small Round)	7 17 6	—
Hoops (Baling)	11 0 0	11 0 0
„ (Soft Steel)	10 0 0	10 0 0
Plates	8 7 6	—
„ (Lancs. Boiler)	11 5 0	—
Sheffield—		
Siemens Acid Billets	10 0 0	—
Hard Basic	8 2 6 to 8 12 6	
Intermediate Basic	7 12 6	—
Soft Basic	7 0 0	—
Hoops	11 10 0	—
Soft Wire Rods	9 5 0	—
Midlands—		
Small Rolled Bars	7 15 0 to 8 0 0	
Billets and Sheet Bars	6 10 0 to 6 15 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	14 0 0	—
Angles	7 12 6	—
Joists	7 12 6	—
Tees	8 12 6	—
Bridge and Tank Plates	8 7 6	—
Boiler Plates	11 0 0 to 11 10 0	

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/6 to 18/9
Block Tin (cash)	289 0 0
„ (three months)	283 0 0
Copper (cash)	55 13 9
„ (three months)	55 17 6
Spanish Lead (cash)	23 18 9
„ (three months)	24 8 9
Spelter (cash)	28 17 6
„ (three months)	28 10 0
Manchester—	
Copper, Best Selected Ingots	61 10 0
„ Electrolytic	62 10 0
„ Strong Sheets	86 0 0
„ Tubes (Basis Price) lb.	0 1 0½
Brass Tubes (Basis Price), lb.	0 0 11½
„ Condenser, lb.	0 1 1½
Lead, English	25 12 6
„ Foreign	24 15 0
Spelter	29 5 0
Aluminium (per ton)	£107

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/4 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 10 0	7/6
„ „ 6 p.c. to 8 p.c. „	£22 15 0	7/3
„ „ 8 p.c. to 10 p.c. „	£22 7 6	6/6
„ „ Specially Refined Max. 2 p.c. carbon	£36 5 0	11/6
„ „ „ 1 p.c. „	£42 5 0	13/–
„ „ „ 0·70 p.c. carbon	£54 0 0	17/6
„ „ „ carbon free	1/5 per lb.	
Metallic Chromium	3/3 per lb.	
Ferro Manganese (per ton)	£12 10 0	for home, £16 for export
„ Silicon, 45 p.c. to 50 p.c.	£12 0 0	scale 5/– per unit
„ „ 75 p.c.	£19 5 0	scale 6/– per unit
„ Vanadium	14/3 per lb.	
„ Molybdenum	5/– per lb.	
„ Titanium (carbon free)	0/11½ per lb.	
Nickel (per ton)	£170	
Ferro-Cobalt	9/3 per lb.	

FUELS.

SCOTLAND.

(Prices not stable.)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	13/6
„ „ Ell	13/9
„ „ Splint	15/6 to 17/6
„ „ Trebles	15/6 to 16/–
„ „ Doubles	14/6 to 15/–
„ „ Singles	13/6
Ayrshire—	
(f.o.b. Ports)—Steam	14/–
„ „ Jewel	15/6
„ „ Trebles	16/–
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	11/9 to 13/9
Screened Navigation	18/– to 19/–
Trebles	16/9 to 17/6
Doubles	15/6 to 16/–
Singles	13/6
Lothians—	
(f.o.b. Leith)—Best Steam	13/–
Secondary Steam	12/3
Trebles	16/3 to 16/6
Doubles	15/– to 15/6
Singles	13/6

ENGLAND.

	Inland.
(5) N.W. Coast—	
Steams	22/6
Household	42/6 to 58/6
Coke	24/– to 24/6
Northumberland—	
Best Steams	14/6
Second Steams	13/– to 13/6
Steam Smalls	10/6
Unscreened	13/– to 13/6
Household	21/– to 27/–
Durham—	
Best Gas	16/– to 16/3
Second	14/– to 14/6
Household	21/– to 27/–
Foundry Coke	19/– to 26/–
Sheffield—	
Best Hand-picked Branch	27/6 to 28/6 —
Best Selected House Coal	21/– to 22/6 —
Screened House Coal	19/– to 21/– —
„ „ Nuts	16/– to 17/6 —
Yorkshire Hards	16/– to 17/– —
Derbyshire Hards	16/– to 17/– —
Rough Slacks	10/6 to 11/6 —
Nutty Slacks	8/– to 9/– —
Smalls	3/– to 5/6 —
Blast-furnace Coke (Inland)	21/– to 22/–* —
„ „ (Export) f.o.b.	18/6 to 20/–

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	20/– to 20/6
Second Smokeless Large	19/– to 19/6
Best Dry Large	19/– to 19/6
Ordinary Dry Large	18/– to 18/6
Best Black Vein Large	18/6 to 19/–
Western Valley Large	18/– to 18/6
Best Eastern Valley Large	17/6 to 18/–
Ordinary Eastern Valley Large	17/– to 17/6
Best Steam Smalls	13/6 to 14/–
Ordinary Smalls	12/– to 13/–
Washed Nuts	18/– to 21/–
No. 3 Rhondda Large	20/6 to 21/–
„ „ Smalls	16/– to 16/6
No. 2 „ Large	17/– to 17/6
„ „ Through	15/6 to 16/–
„ „ Smalls	13/– to 13/6
Foundry Coke (export)	40/– to 42/6
Furnace Coke (export)	27/6 to 30/–
Patent Fuel	23/6 to 24/6
Pitwood (ex ship)	29/– to 29/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	35/– to 38/–
Seconds	28/– to 32/6
Red Vein	25/– to 30/–
Machine-made Cobbles	42/6 to 45/–
Nuts	40/– to 45/–
Beans	30/– to 32/6
Peas	19/– to 21/–
Breaker Duff	8/– to 8/6
Rubbly Culm	8/6 to 9/–
Steam Coals:	
Large	18/6 to 19/6
Seconds	17/6 to 18/6
Smalls	10/– to 11/–
Cargo Through	16/– to 17/–

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayreshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/– extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow (b) Delivered Sheffield. (c) Delivered Birmingham. * Official quotation for pig iron producers.

French Engineering Notes.

(From our Correspondent in Paris.)

Naval Construction.

THE failure of the Senate to vote the credits necessary for putting the new batch of war vessels on the stocks during the coming year will not interfere with the carrying out of the programme. The Minister of Marine has received assurance that the credits will be voted on the re-assembling of Parliament, and he is therefore giving out contracts for the vessels to be built so that there will be no delay in executing the work, which will comprise the laying down during the year of one cruiser, six destroyers, five first-class submarines, one submarine minelayer, and two light vessels for foreign service. The original programme provided for three destroyers and four torpedo boats having a total tonnage of 14,100 tons, but these vessels have been replaced by six destroyers having the same total tonnage, the idea being to build a larger number of destroyers of the same type for the sake of economy. The programme undergoes some modification every year, and amongst new designs to be presented will be a type of seaplane carrier much smaller than the 10,000-ton Béarn.

The Coal Trade.

A visit to some of the ports that receive foreign coal appears to confirm the views being expressed in some quarters concerning the situation of the coal trade. Apart from the usual season's decline in the consumption of domestic coals, the requirements for industrial purposes have fallen off considerably, and this, too, at a time when the stocks of fuel are heavy and continue to accumulate. There is at present no visible sign of a possible recovery, for it has become perfectly clear that the industrial prosperity, which ended with the stabilisation of the franc, was due entirely to the artificial advantages provided by a debased currency for transacting business abroad and also to the work of reconstruction in the devastated areas, which is now practically completed. On the other hand, manufacturers affirm that they would be in a much better situation for securing foreign business if they could obtain cheaper supplies of coal and coke, and while German coke oven owners are little disposed to lower prices for consignment to France, although they are executing large contracts at reduced figures elsewhere, the prices of coal are being maintained by the operation of the licence system for the benefit of French coalowners. It is curious to observe that, even at Rouen, which depends for its prosperity largely upon the traffic in British coal, efforts are being made to push the sale of other foreign coals, notably from Poland, while the supplies of anthracite offered include what are called "British kinds," which means that they are claimed to be similar to Welsh anthracite, and also "French anthracite," which is obviously not French at all, unless it may be the product of the Mines Domaineales of the Saar. Metallurgical coke is also offered as a substitute for anthracite for domestic heating. All the French and foreign anthracite sold is distinctly inferior to the Welsh, but on account of the lower prices it is to be feared that it will become a serious competitor to Welsh anthracite.

Flood Reservoirs.

The Municipal Commission of the Port of Paris has approved of a scheme for the construction of barrage reservoirs as a means of regulating the level of the Seine and preventing a recurrence of floods. It is proposed to construct the Crescent and Chaumaçon reservoirs which will hold up 24 million cubic metres of water during periods when the Seine valley is threatened with inundations, and the water will be returned to the river in dry seasons. It is also intended to utilise the reservoirs for power distribution, and it is even proposed to draw upon them for the Paris water supply. The cost of the works is estimated at 48 million francs. The town of Paris has also been authorised to carry out additional flood protection works at a cost of 14,785,000*f.*, one-third of which will be provided by the State.

Port Vendres.

In perfecting the means of communication between the South of France and North Africa one of the objects is to provide against the dangers arising from navigation in or near the Gulf of Lyons, where the prevalence of storms and heavy seas make it risky for ships to run for shelter to Cette. It has long been proposed to improve access to Port Vendres, which is a natural port; but is at present practically abandoned because none of the navigation companies can be induced to make it a regular port of call. The Midi Railway Company has made several attempts to arrange with shipping companies, and has even offered to acquire and run three ships between Port Vendres and Algeria, but all the negotiations fell through on account of financial difficulties. The Government has approved of a scheme for carrying out the necessary works, comprising an extension of the wharves, the deepening of the channel to the old dock and the deepening of the new basin.

Tangier-Fez Railway.

Although the railway between Tangier and Fez has only just been officially opened, it has been working over a part of the distance for some time past, the section between Fez and Petitjean having been opened in 1924, while the short line between Petitjean and Souk-el-Arba was put into service a year ago. The extension of the line from Souk-el-Arba to Tangier completes the line, the total length of which is 193 miles. Including the branch lines to Casablanca, the total length of the system is 415 miles. Tangier is thus no longer isolated by the Spanish zone, where there was, until the construction of the railway, a complete absence of means of communication, and the harbour works being carried out to provide for the future traffic depending upon the railway, are expected to make Tangier a considerable port of transit. For years past great efforts were made by the French to secure a monopoly of the harbour works at Tangier, and an elaborate scheme was prepared involving an expenditure which they could not provide for, and much of the work now in hand is being undertaken by a British company.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

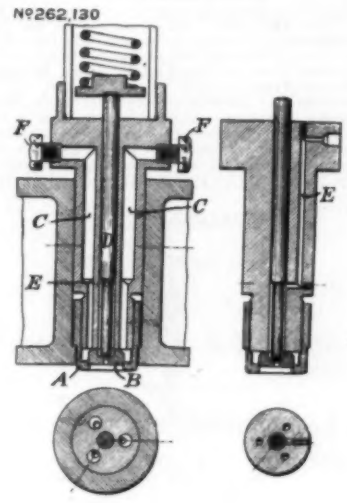
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

262,130. November 26th, 1926.—IMPROVEMENTS RELATING TO INJECTION NOZZLES FOR DIESEL ENGINES, *Motorenfabrik Deutz Aktiengesellschaft, of Koln-Deutz, Germany.*

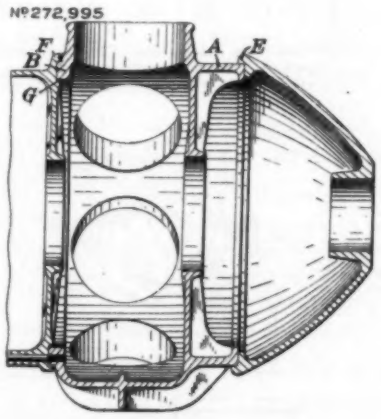
In Diesel engines working with air-free injection and viscous fuel injected by closed nozzles of large dimensions, the upper part of the nozzle is so cold that the viscosity of the oil leaking between the valve spindle and its guide prevents the free movement of the spindle. Viscous fluids are usually pre-heated in order that they should be able to pass freely through the narrow cross section of the nozzle. Such pre-heating is not, however, possible for the oil which slowly leaks between the valve spindle



and its guide, and the oil is cooled at those parts. The invention obviates this drawback by a circulation of heat from the hottest part of the nozzle to the spindle guide. When the engine is working the cap A and the nozzle plate B are heated by the combustion of the fuel and impart their heat to the liquid filling the chamber space. A natural circulation is set up in the upper portion of the channel C, and the guide of the spindle D is heated, so that the oil leaking between the spindle and guide remains in a sufficiently thin condition to allow free movement of the valve. The valve is pressed on its seat in the usual manner by a spring, and is only released when the oil is forced at high pressure into the channel E. The channels C are filled with lubricating oil and are either open at their upper ends or closed by plugs F.—*June 30th*, 1927.

272,995. March 23rd, 1926.—IMPROVEMENTS IN CRANK CASES OF RADIAL CYLINDER INTERNAL COMBUSTION ENGINES, Armstrong-Siddeley Motors, Ltd., and Spirito Mario Viale, both of Armstrong-Siddeley Works, Park Side, Coventry.

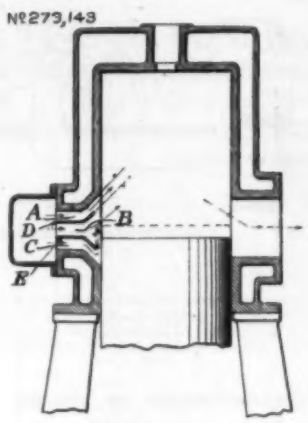
The drawing shows a central vertical section through the crank case of a radial multi-cylinder aircraft engine, and its end covers are constructed in accordance with the invention. The crank case is designed to receive radial cylinders, each registering with the apertures shown. These apertures weaken the crank case,



and it is usual to make the crank case very substantial. To avoid this, each side of the crank case has a projecting flange, as shown at A and B, and each end cover is of greater diameter than the flange and is provided with a lip E F, which surrounds and grips the end of the projecting flange. The left-hand cover is also provided with an internal shoulder G, and between this and the lip F there is an annular recess into which the flange B enters. This considerably stiffens the crank case, and its weight may be reduced without risk of distortion or other defects.—*June 23rd*, 1927.

273,143. November 1st, 1926.—IMPROVEMENTS IN SCAVENGING PORTS FOR THE CYLINDERS OF INTERNAL COMBUSTION ENGINES, *Leonard Mellersh-Jackson, of the firm of Haseltine, Lake and Co., of 28, Southampton-buildings, Chancery-lane, London.*

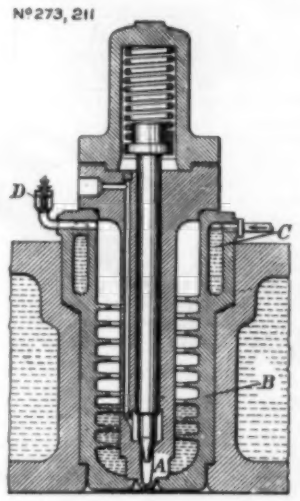
A form of scavenging port is described that is applicable to Diesel engines, and by means of this special port the air is caused to travel in the cylinder in the most advantageous manner from the point of view of scavenging. The port has three passages A, B and C, which are formed by means of guide vanes D and E. The scavenging air from the receiver passes into the cylinder in three separate streams, each having a definite direction. Moreover, as the pressure drop in the scavenging ports is compara-



tively small, each of the air streams attains its maximum velocity at the narrowest passages, through which the streams pass. The invention ensures that the scavenging air is delivered to the cylinder in an upward direction, and it is claimed to increase the efficiency of the scavenging.—*June 30th*, 1927.

273,211. March 9th, 1927.—COOLING INJECTION NOZZLES, C. Schaer, Langenthal, Switzerland.

For the purpose of cooling the fuel injection nozzle of an internal combustion engine, the inventor surrounds the nozzle casing A with a jacket B, which is partially filled with a liquid (distilled water is recommended). The jacket is provided with

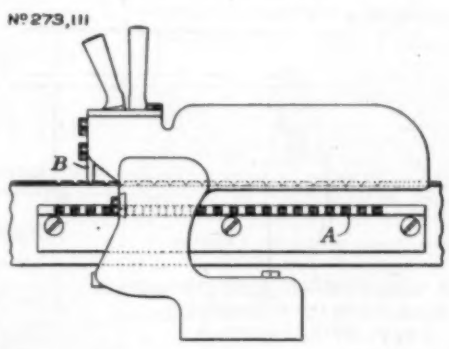


radiating fins, as shown, and a special cooling water jacket C. The result is that the water in the lower part of the jacket B cools the nozzle by evaporation, and, being re-condensed in the upper part, drops to the bottom again and is available to continue the process. D is a device which acts as a filler and safety valve combined.—*June 30th*, 1927.

MEASURING AND TESTING INSTRUMENTS.

273,111. July 26th, 1926.—STEELYARDS, W. and T. Avery, Ltd., Soho Foundry, Birmingham, and A. Balfour.

This invention is concerned with weighing machines in which the poise weight is positioned accurately by means of a pointed "nib" engaging with V notches on the steelyard, and is roughly positioned by a more substantial nib engaging with a "protec-



tion" bar, in order that the V notches may be saved from undue wear. Generally the protection bar is an upright rack with rectangular teeth, but it tends to become clogged with rubbish, and is then inoperative. The inventor consequently turns the rack on its side, as shown at A, so that any dirt may fall straight through. The V nib is shown at B.—*June 30th*, 1927.

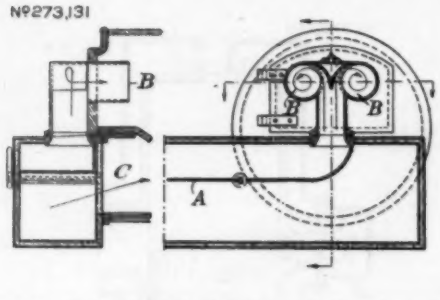
FURNACES.

273,131. February 25th, 1926.—FURNACES OF FLUE BOILERS, *A. J. H. Haddan, 31, Bedford-street, Strand, London, W.C. 2.*

It is suggested in this specification that the reason why Lancashire and similar boilers cannot be forced to greater outputs is

the fact that there is not sufficient room in the furnace for the development of a long flame. The inventors—the Ljungstrom company—consequently supply air above the fire in a spiral jet with the idea of creating a rotary flame and correspondingly

No 273,131



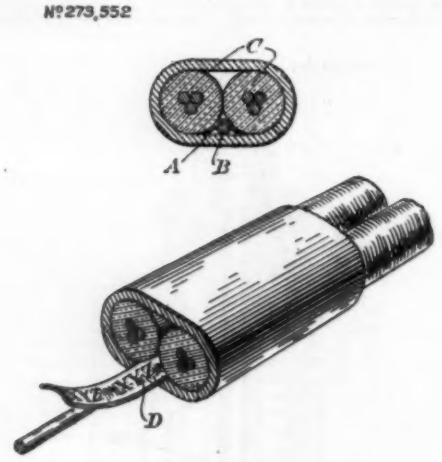
increasing its length within defined overall dimensions. The means of producing the spiral jet are obvious in the drawing. The damper A can be used to determine the amount of draught going to the jets B B and to the ashpit C.—*June 25th*, 1927.

TRANSMISSION OF POWER.

273,552. October 25th, 1926.—Improvements in or relating to Metal-sheathed Electrical Conductors, Callender's Cable and Construction Company, Ltd., of Hamilton House, Victoria Embankment, London, E.C. 4, and John Bowyer, of Anchor Works, Leigh, Lancashire.

The metal-sheated electrical conductors to which this invention applies are of the type having a bare metal continuity wire or bonding wire or strip within the sheath in addition to the insulated conductors. The continuity wire fails to fulfil its purpose unless it is in electrical contact with the inner wall of

No 273,552



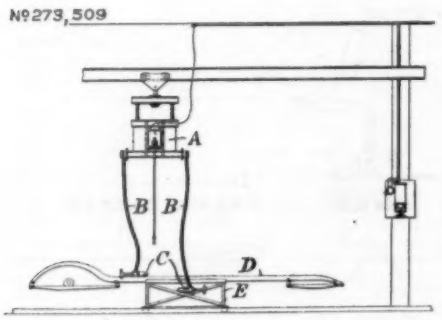
the metal sheath. According to this invention, a strip of relatively hard paper A is interposed between the bare wire B and the insulated conductors C. This strip not only separates the bare wire from these conductors, but tends to maintain the wire in contact with the inner wall of the sheath throughout its length. The strip also serves to indicate the origin of the cable by bearing the maker's name, as shown by X Y Z in the lower drawing. Other information, such as the date of manufacture, grade and quality of the wire, &c., may be marked on the strip. —*July 7th*, 1927.

MACHINE TOOLS AND SHOP APPLIANCES.

273,509. July 23rd, 1926.—Improvements relating to Electric Rivet Heaters, Frank William Highfield and the Highfield Electrical Company, Ltd., both of Faraday Works, Holbrooks-lane, Coventry.

Although this invention is mainly applicable to riveting together the component parts of motor car parts, it may also be used for other riveting operations. A transformer A is carried on a runway, and a pair of flexible conductors B have electrodes

No 273,509



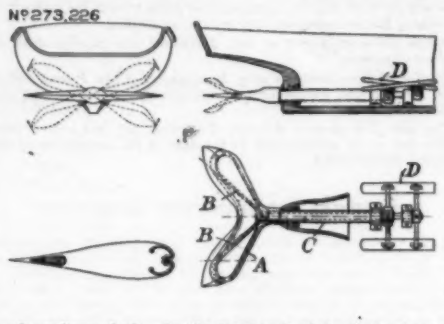
C connected at their ends, and these electrodes can be pressed by hand against the opposite ends of the rivets. The chassis D is carried on a truck E. Prior to heating, the rivet is placed in position, and the electrodes are then made to heat it. When the rivet is sufficiently hot, the electrodes are removed and the riveting is completed by hammering. The electrical control gear is shown on the right of the drawing.—*July 7th*, 1927.

SHIPS AND BOATS.

273,226. April 28th, 1927.—An Oscillating Propeller, O. Hansson, Slottet, Finspong, Sweden.

This propeller is evidently intended for small shallow-draught boats, and has the merit that it offers very little resistance when not in use. It is built up of two pairs of stiffening arms A A and B B connected by flexible diaphragms. The arms A A are fixed to a hollow propeller shaft C, while the arms B B are keyed

No 273,226



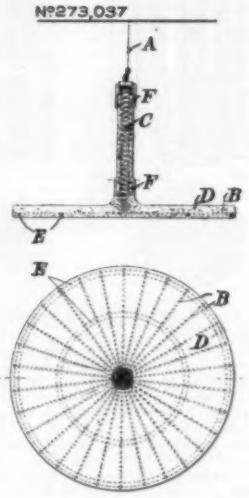
to a loose inner shaft. On the inner ends of the shafts there are arms equipped with pedals D. By suitably operating these pedals the propeller can be flexed and oscillated so as to drive the boat ahead or astern.—*June 30th*, 1927.

MISCELLANEOUS.

273,037. April 8th, 1926.—Improvements in or relating to Lightning or Surge Arresters, Electrical Improvements, Ltd., of Milburn House, Newcastle-upon-Tyne, and Lewis Colin Grant, of Wandsworth House, Heaton, Newcastle-upon-Tyne.

The power line is connected directly or through a spark gap A or condenser to a conducting body, which is laid in the earth or is adjacent to the earth. This body constitutes with the earth a condenser having sufficient dielectric hysteresis to cause the dissipation of a considerable percentage of the surge energy,

No 273,037

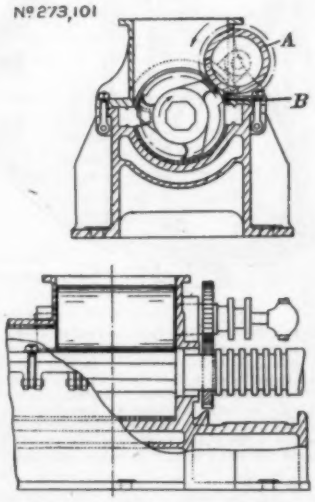


and therefore prevents dangerous quantities of that energy being fed back into the line. The conducting body is consists of a series of conductors B, composed, for example, of wire or strip, and radiating from a common centre and their ends are bent to form a lead down conductor C. The conductors are embedded in concrete D, and the radiating conductors are secured to rings E, which may be composed of conducting or insulating material. In order to hold the conductors in position before they are embedded in the concrete, one or more clamps F are provided. The conductors may be either bare or insulated.—*June 30th*, 1927.

273,101. July 5th, 1926.—Mixing Machines, Sir M. Nairn, Dysart House, Dysart, Fife.

This invention is concerned with the feed gear of that type of mixing machine used in the manufacture of linoleum, commonly known as a "German." Such a machine comprises a set of hooked knives, on a shaft, rotating in a cylinder between fixed

No 273,101

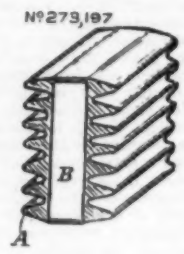


knives. It is sometimes found that the material does not feed forward along the cylinder, and is merely churned up. The inventor consequently provides a hollow roll A in the side of the feed hopper, which nearly contacts with the ends of the knives. The roll is positively driven from the main shaft, and may be cooled or heated internally as required. B is a stationary doctor knife for keeping the roll clean.—*June 30th*, 1927.

273,197. February 4th, 1927.—Improvements in Permanent Magnets made of Steel, Josef Zacher, of Stallschreiberstrasse, 41/42, Berlin, Germany.

According to this invention permanent magnets are composed of a hollow steel shell A, provided with soft iron end pole pieces B, and the main body of the magnet is corrugated as shown.

No 273,197

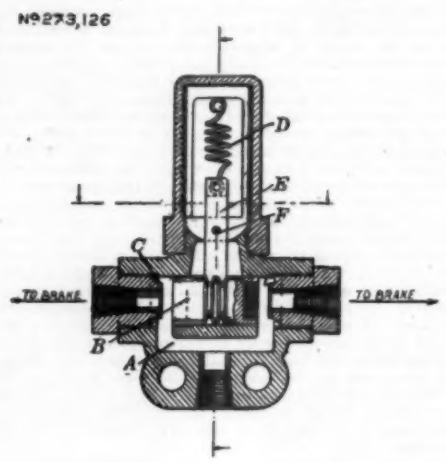


The seat of the magnetism in permanent magnets, the inventor states, is predominantly on or near the surface of the steel body, and therefore with the same degree of saturation and the same kind of steel, the magnetic force depends in a higher degree on the area of the surface than it does on the volume of the steel.—*June 30th*, 1927.

273,126. September 28th, 1926.—Isolating Valves, *E. C. R. Marks*, 57, *Lincoln's Inn-fields, London, W.C.*

This valve is intended for sealing the end of, for instance, the pipe line of a compressed air brake when the pipe beyond is broken and an abnormal loss of air would otherwise take place. In ordinary circumstances there is a free passage for the air,

No 273,126



through the valve, by way of the port A. If, however, there is an abnormal rush of air to, say, the left, the valve B is forced over on to the seating C and closes the outlet. The valve B is ordinarily held in the mid position by the tension of the spring D tending to keep the lever E pivoted at F, in an upright position.—*June 20th*, 1927.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

WEDNESDAY TO WEDNESDAY, AUGUST 31st TO SEPTEMBER 7th.

British Association for the Advancement of Science.—Meetings at Leeds.

TUESDAY TO FRIDAY, SEPTEMBER 6th TO 9th.

The Institute of Metals.—Annual meeting at Derby. For programme see page 148.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

Universal Postal Frankers, Ltd., asks us to announce that the address of its office has been changed from Morning Post Building, 346, Strand, W.C. 2, to Victory House, 99–101, Regent-street, London, W. 1. New phone number, Gerrard 8563.

LAUNCHES AND TRIAL TRIPS.

Beaconstreet, oil tank steamer; built by Palmer's Shipbuilding and Iron Company, Ltd., to the order of the Beacon Oil Company, of Boston, U.S.A.; 11,500 tons deadweight. Engines, triple-expansion; constructed by the builders; trial trip, July 13th.

Berta, oil tanker; built by Harland and Wolff, Ltd., to the order of the Anglo-Saxon Petroleum Company, Ltd.; dimensions, 305ft. by 50ft. by 15ft.; 2700 gross tonnage. Engines, two sets of triple-expansion, 13½in., 23½in., 36in., with 27in. stroke, pressure 180 lb.; constructed by the builders; trial trip, July 14th.

Urdaneta, twin-screw oil tank steamer; built by Palmer's Shipbuilding and Iron Company, Ltd., to the order of the Venezuela Gulf Oil Company. Engines constructed by MacColl and Pollock, Ltd.; constructed on the Isherwood system of longitudinal framing; launch, July 14th.